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PART I THEORY OF OPERATION

CHAPTER 1 Mechanical Theory

1. Ink Jet Printer

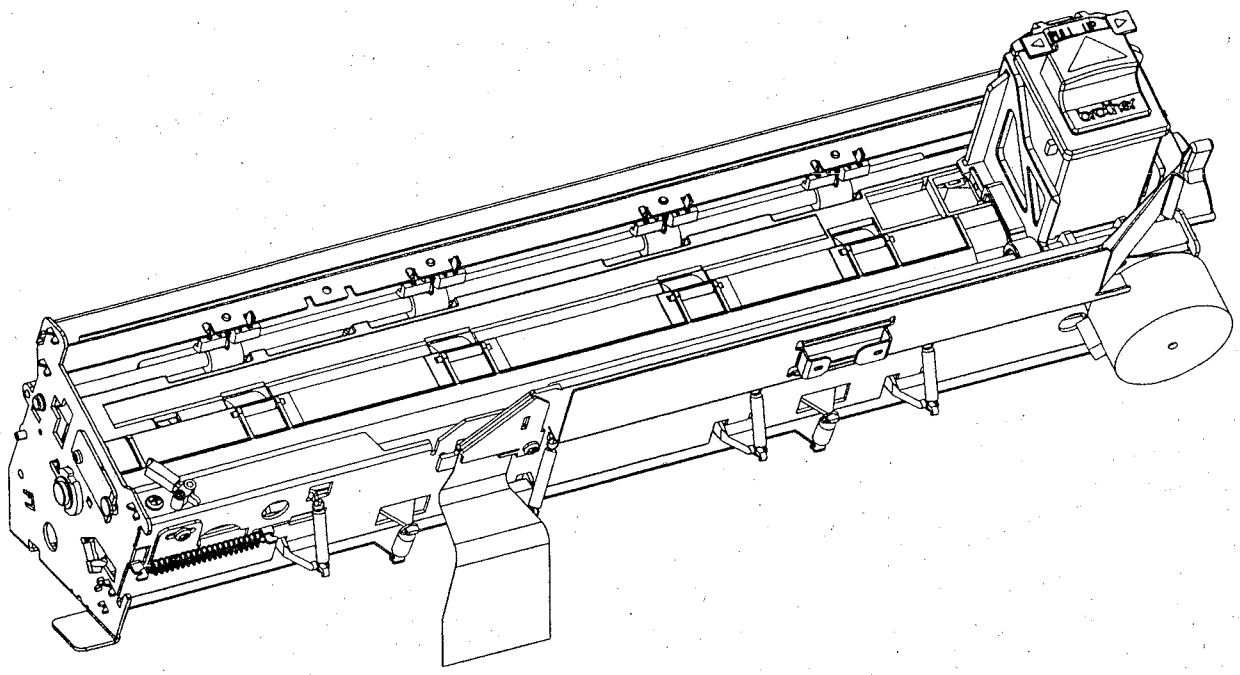

Fig. 1.1 – Ink Jet Printer Assembly

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1.1 Ink Jet Printer System Configuration

The ink jet printer contains the following components:

1. Carriage Assembly

   The carriage assembly consists of the carriage and ink cartridge (the cartridge contains the ink jet nozzles). The carriage consists of the carriage bearings, head-locker & spring, the rubber pad, and the flat cable.

2. Carriage Motion Control System

   The carriage motion control system consists of the carriage motor, motor pulley, timing belt, and the idle pulley assembly.

3. Line Feed System

   The line feed system consists of paper feed motor, idle gear, and a main roller gear.

4. Paper Feed & Adjustment System

   The paper feed system consists of the paper separator, main paper pan and pinch rollers, top paper guide and pinch rollers, main roller assembly, star-wheel roller assembly, and star-wheel assemblies (attached to the carriage rail). Paper adjustment is accomplished by the paper adjustment lever and the paper pan pressure plate & extension springs (mounted to the printer front frame).

5. Maintenance Station

   The maintenance station consists of the maintenance station carriage assembly (carriage, rubber cap, plunger, compression spring, and extension spring); the wiper; felt ink absorbers (in spitting trough and under carriage ass'y); and the cover.

6. Sensors

   There are 2 sensors in the printer assembly: the carriage home position switch (attached to the top left end of the front frame) and the paper end sensor (attached to the bottom of the main paper pan at the left rear).

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1.2 Ink Jet Printer Operation

1.2.1 Carriage Assembly

The carriage assembly consists of the carriage and ink cartridge (the cartridge contains the ink jet nozzles). The carriage consists of the head-locker & spring, the rubber pad, bearings, and the flat cable. The flat cable connects to the main PCB. See Fig. 1.2.

The printer flat cable must be firmly in contact with the ink jet cartridge for printing to be enabled. The flat cable is located in the carriage by three alignment pins; proper alignment of the cartridge to the cable is established in three datums (reference planes/points): X, Y, and Z. When the cartridge is installed in the carriage, the flat cable contacts are compressed against the cartridge contacts by the rubber pad. See Fig. 1.3 and Fig. 1.4.

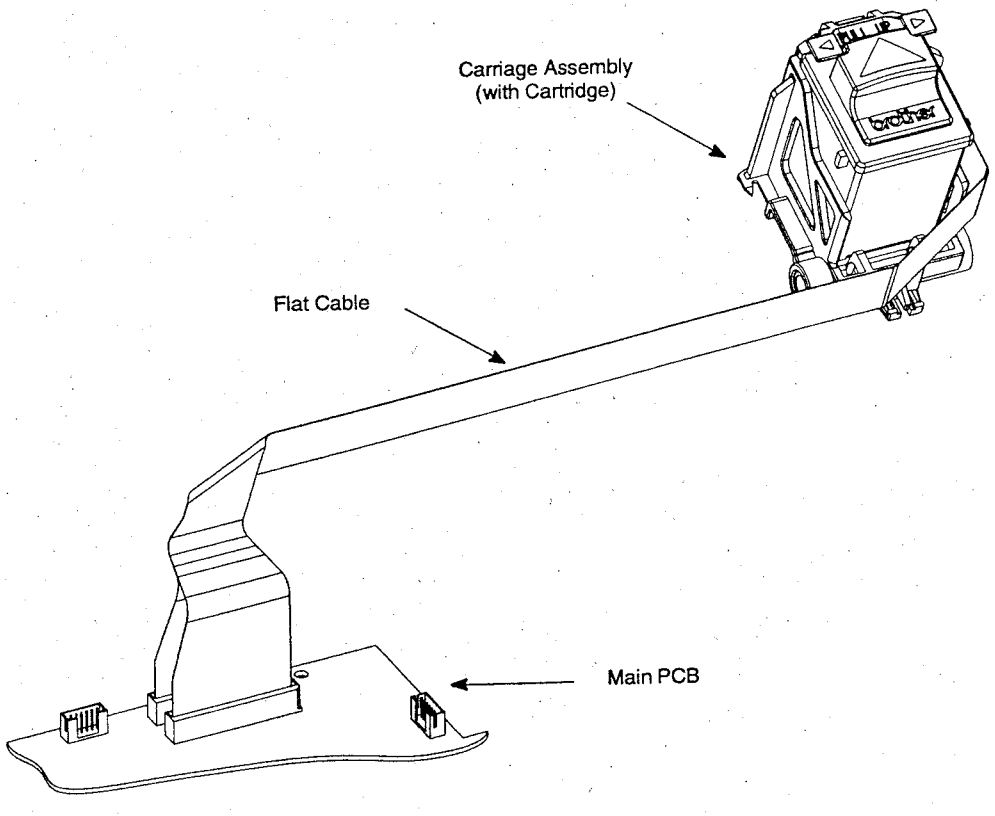


Fig. 1.2 – Printer Flat Cable to Main PCB

Fig. 1.3 – Printer Flat Cable to Carriage Alignment

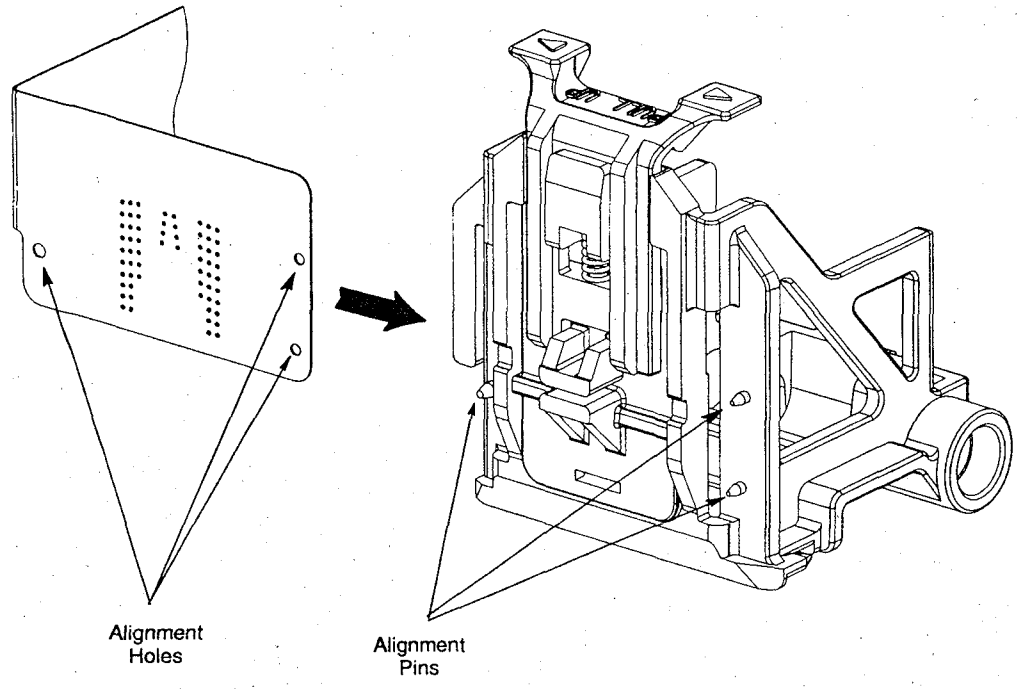
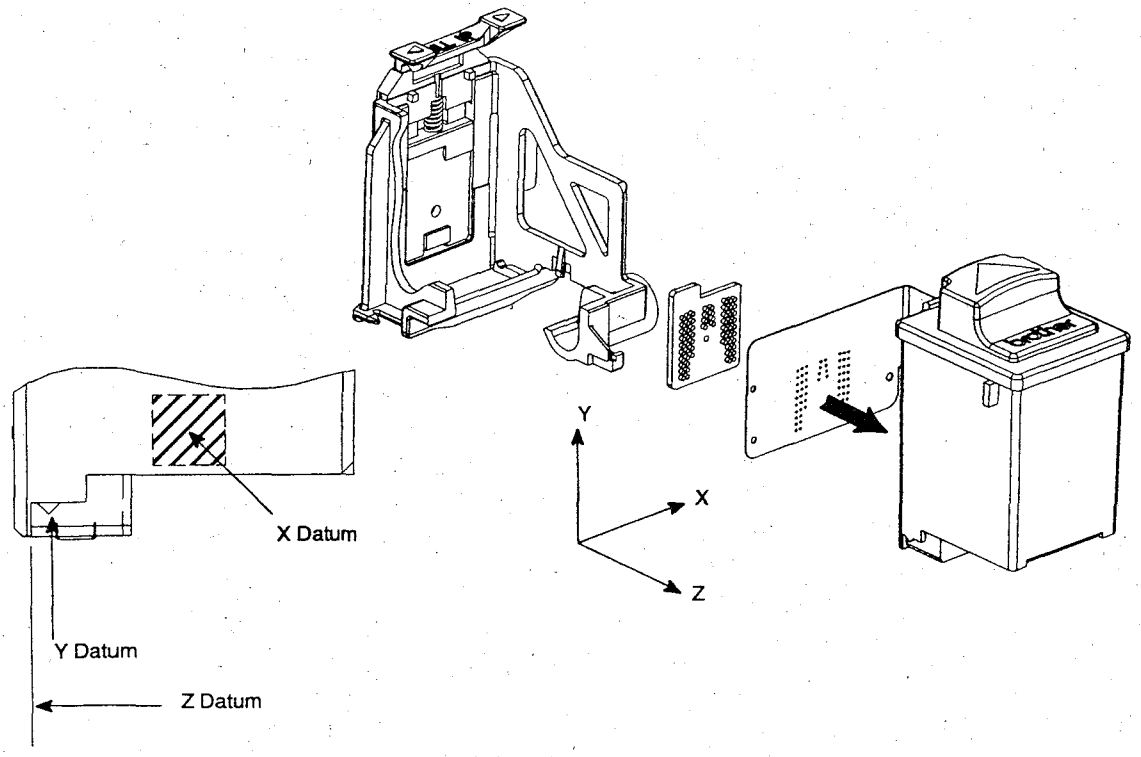


Fig. 1.4 – Ink Jet Cartridge to Flat Cable Alignment



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1.2.2 Carriage Motion Control

All operations related to carriage movement are driven by the carriage motor. The carriage motor assembly consists of a motor, a timing belt, and an idle pulley and bracket: the motor and the idle pulley bracket are mounted to the printer frame; the belt runs between the motor and the pulley. An extension spring between the idle pulley bracket and printer frame sets belt tension. See Fig. 1.5.

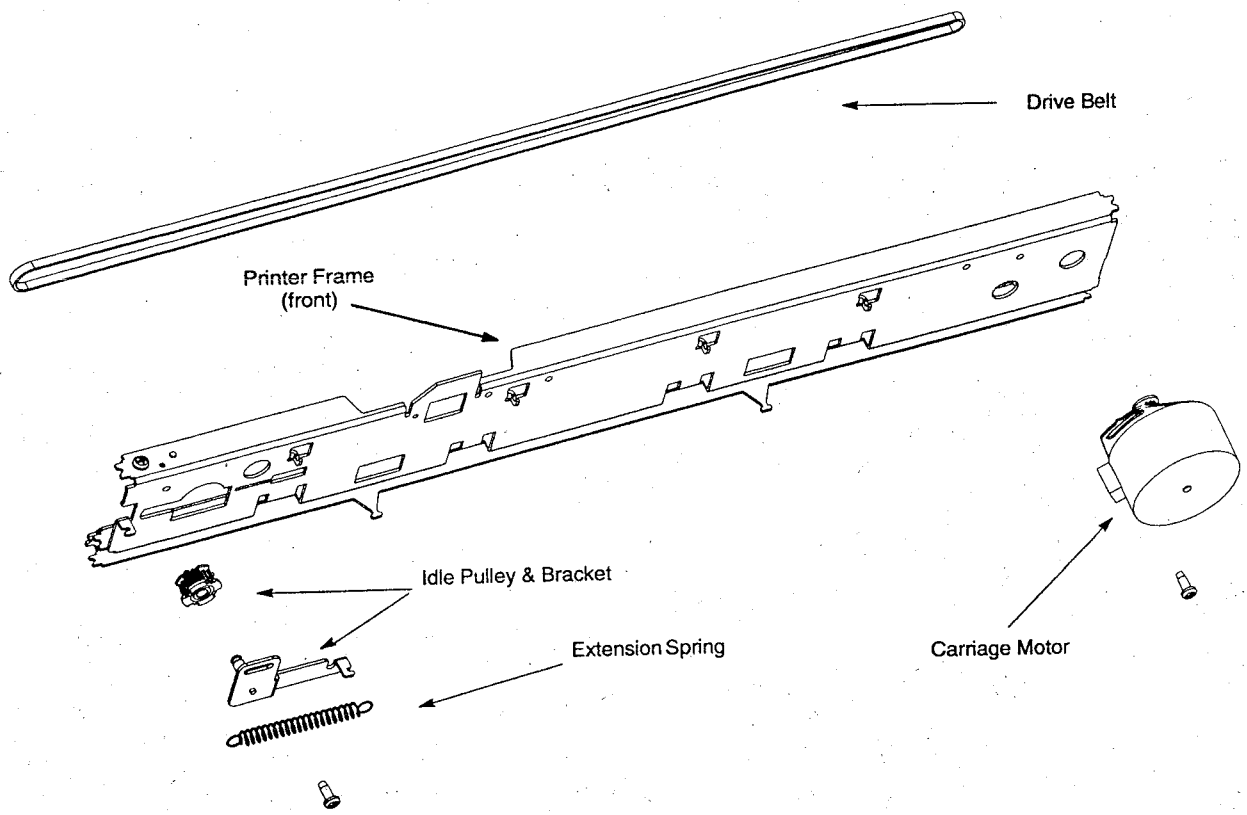

Fig. 1.5 – Carriage Motion Control

1.2.3 Line Feed System

The line feed system consists of line feed motor, idle gear, and a main roller gear. See Fig. 1.6.

The main roller assembly is driven by a line feed motor (stepping motor). The line feed motor is secured to the right end frame with two screws. Rotation of the line feed motor is transmitted to the idle gear and then to the main roller gear.

Line feeding is possible by 1/6 inch (for line-spacing), 1/30 inch (for indexing and reverse-indexing), and continuous feed (for indexing and reverse-indexing).

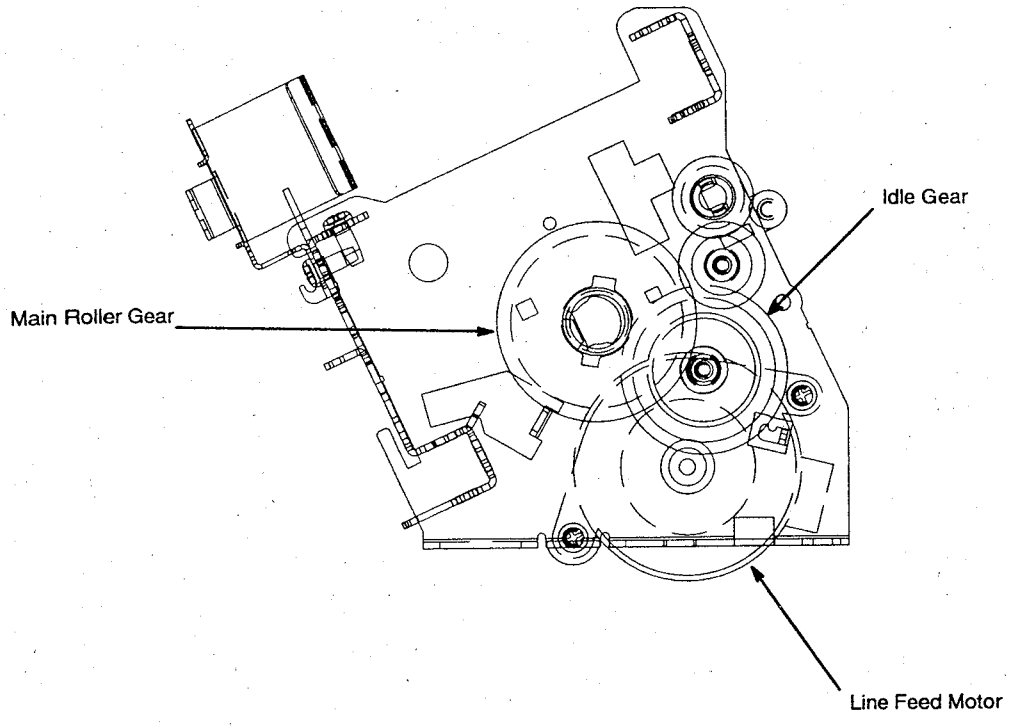

Fig. 1.6 – Line Feed System

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1.2.4 Paper Feed & Adjustment System

Operation

As the main roller assembly rotates, paper is caught and fed between the main rollers and the pinch rollers. The necessary roller pressure is provided by the pressure plate (mounted to the printer front frame), which pushes up the paper pan with the extension springs. Paper adjustment is accomplished by the paper adjustment lever, releasing the force of the pressure plate from the main paper pan.

Paper Feeding (Paper Path)

With the paper adjustment lever in the set position (up), paper is fed into the machine by inserting a sheet of paper into the paper insert slot to just contact the main rollers and bottom pinch rollers. Then pressing the PAPER INSERT key activates the line feed motor to advance the paper to the printing position. See Fig. 1.7

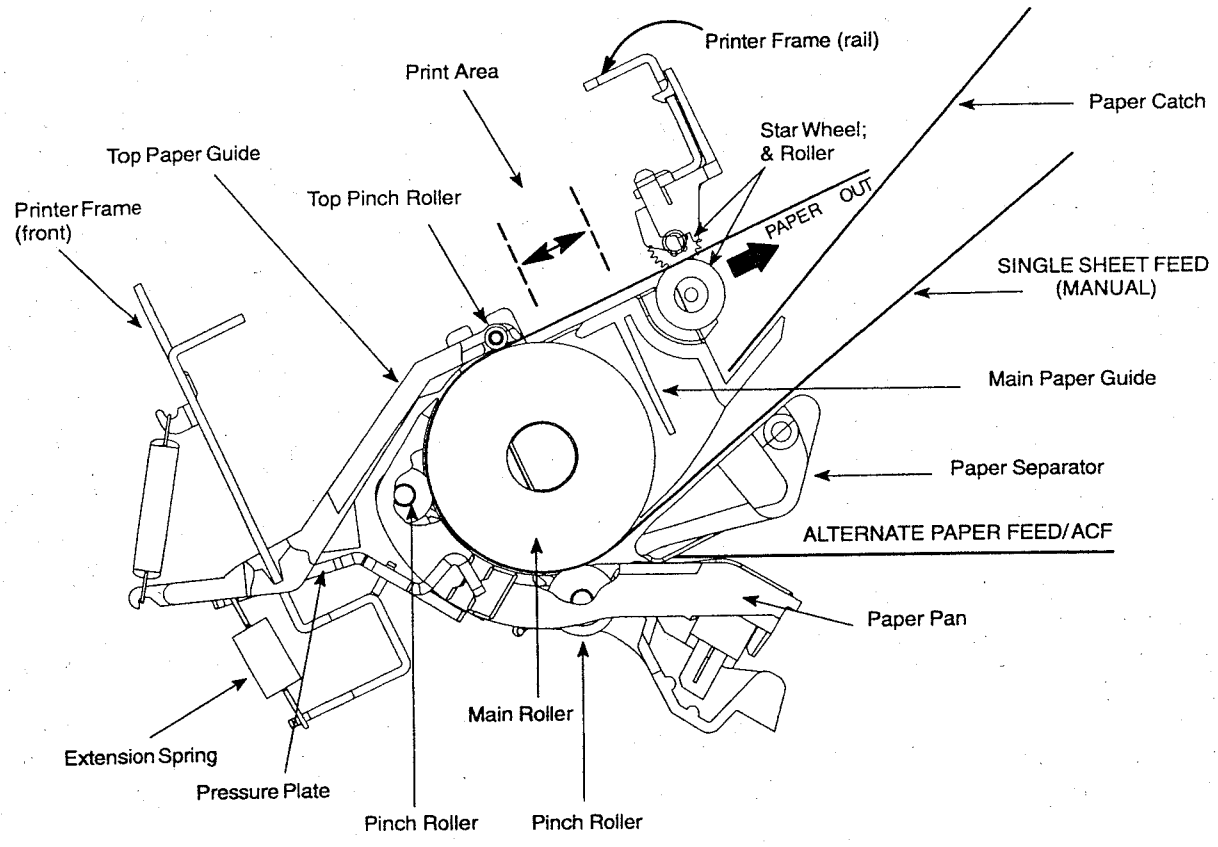

Fig. 1.7 – Paper Feeding

Paper Adjustment

Paper position is adjusted by locking the paper adjustment lever down (toward the front) to release the pressure between the main roller and the pinch rollers. The paper can then be moved for proper alignment. See Fig. 1.8.

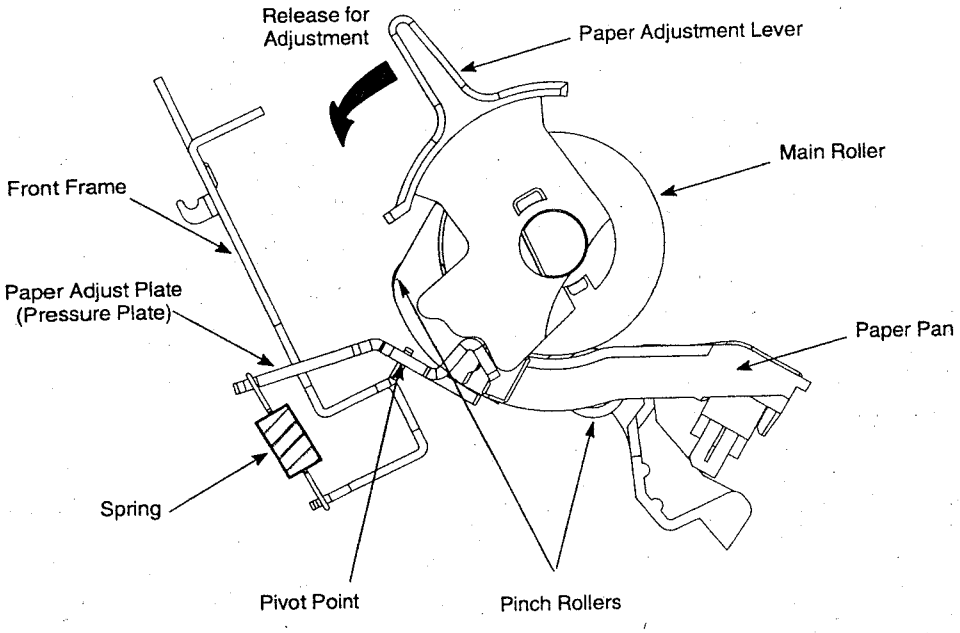

Fig. 1.8 – Paper Adjustment Mechanism

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1.2.5 Maintenance Station Operation

The maintenance operations consist of spitting, wiping, capping, and purging. Table 1.1 below shows a summary of maintenance operations for various printer states.

Printer State	Spitting	Wiping	Capping
Power–on	204	2	1
Beginning print job (after capping for more than 4 minutes)	204 (after wiping)	1	0
Between pages of continuous printing	12	1	0
After 6 pages of continuous printing	204 (after wiping)	1	0
After 50 seconds of printing on the same page	12 (after wiping)	1	0
Purging	6,000 (after wiping)	1	1
After ink cartridge change	1204 (after wiping)	1	1
If no carriage motion for more than 30 seconds	0	1	1
Power–off	0	0	0

Table 1.1 – Summary of Maintenance Operations

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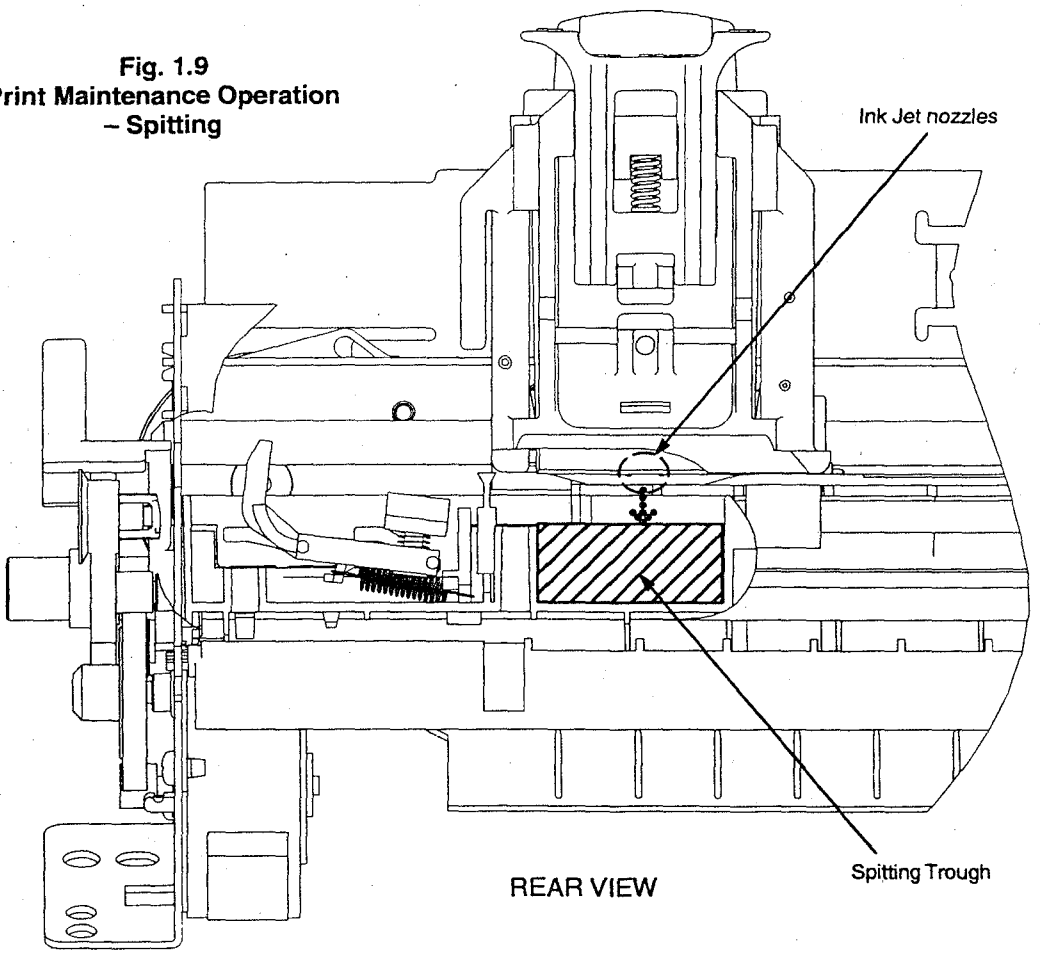
Spitting (see Fig. 1.9)

Spitting is performed at machine power-on, after uncapping from the maintenance station to clear dormant nozzles, and during the printing process to ensure that infrequently used nozzles are available when required to print. There must also be spitting after a wipe cycle, except when the head is going to the cap position; otherwise wiping causes distorted printing if the wiper has experienced any wear.

The trough below the print line is intended to capture the ink during a spit cycle when no paper is present in the print area. The cup around the wiper is used when spitting is required and paper is present in the print area. Spitting with paper in the print area occurs when a single page requires longer than 50 seconds to print. All spitting occurs in the trough. At power on, any paper in the print area is ejected.

Fig. 1.9
Print Maintenance Operation
– Spitting



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Wiping (see Fig. 1.10)

Wiping of the printhead occurs when the carriage moves across the wiper (in either direction). The printhead is wiped (twice) when power is turned on, when beginning a print job (after the printhead has been capped for more than four minutes), after six pages of continuous printing, after 50 seconds of printing on the same page, and after purging or changing the ink cartridge.

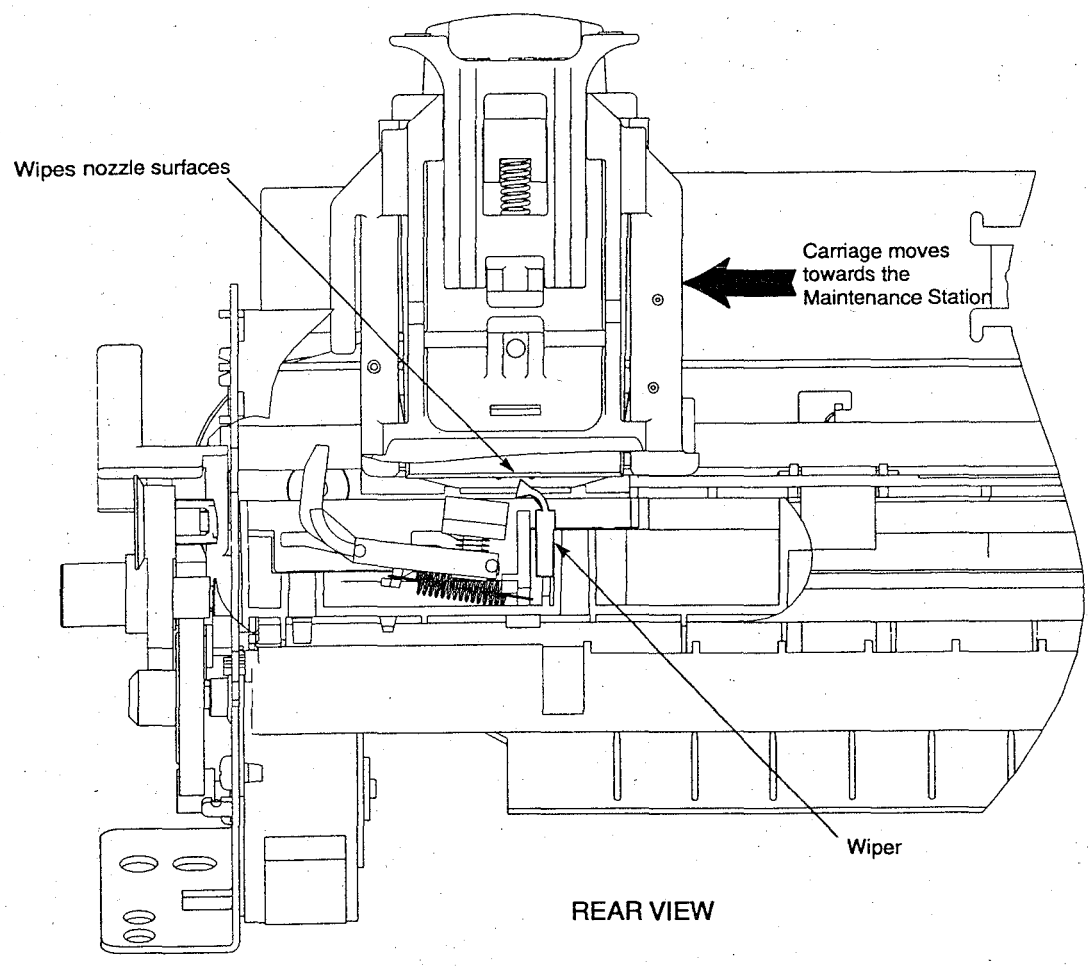

Fig. 1.10
Print Maintenance Operation – Wiping

Capping (see Fig. 1.11)

Capping occurs by the movement of the carriage assembly to the maintenance station, which moves the MS carriage up the ramp to align the cap with the ink jet nozzles. The cap prevents the ink from drying and causing the printhead to clog. The printer will automatically cap the printhead when the system is powered on, when no data is received for 30 seconds, and after purging or ink cartridge change.

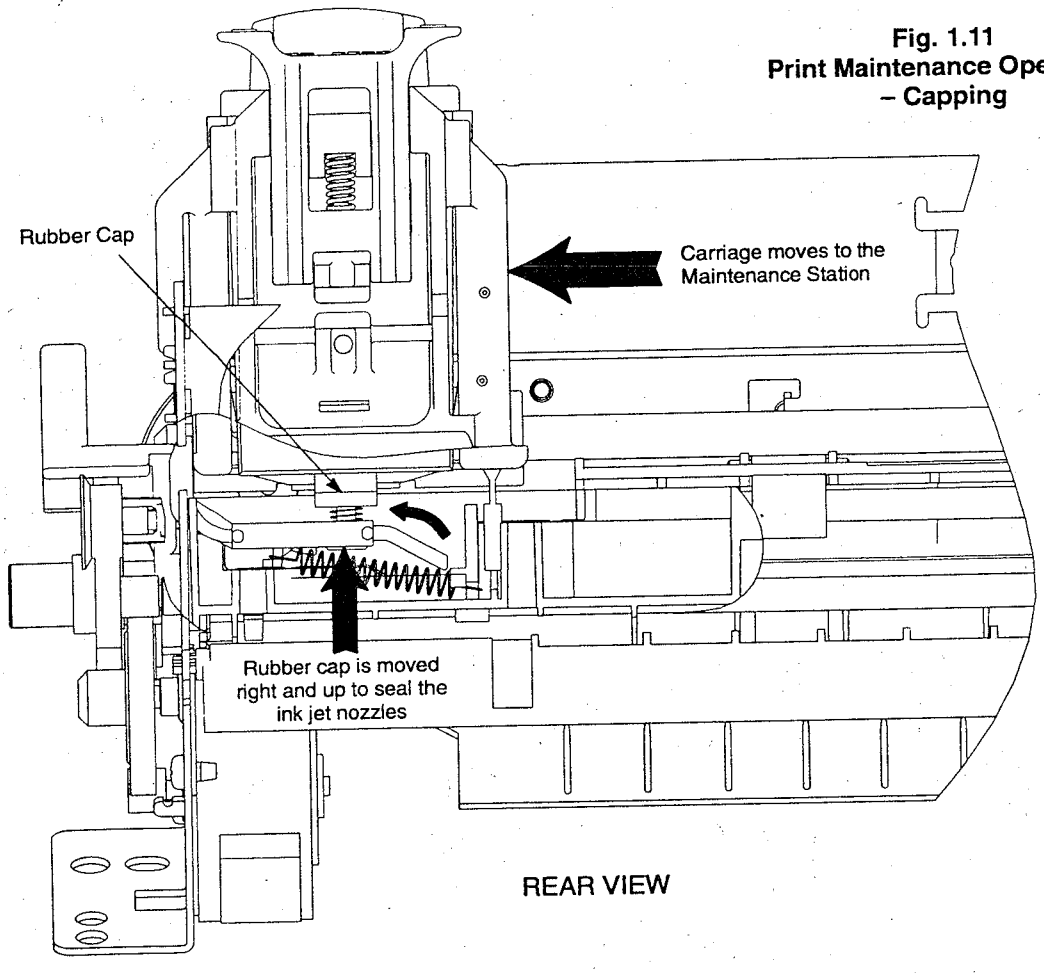
Rubber Cap
Carriage moves to the Maintenance Station
Rubber cap is moved right and up to seal the ink jet nozzles
REAR VIEW

Fig. 1.11
Print Maintenance Operation – Capping

Purging

The purging function of the maintenance station is a combination of the wipe, cap, and spit operations. This initiates a sequence of 6,000 spits of each nozzle, in order to clear clogged ink from the nozzles. The ink is captured in the trough located below the print line. Purging is user-activated by pressing **CODE + SHIFT + INK CHG** from the keyboard. See *Cleaning the Printhead* in Chapter 5, Maintenance, for instructions.

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1.2.6 Sensors

There are 2 sensors in the printer assembly: the carriage home position sensor (attached to the left end of the front frame) and the paper end sensor (attached to the bottom of the main paper pan at the left rear).

Carriage Home Position Switch

Upon power-up of the system or when the carriage is reset, the carriage moves to the left end of the printer assembly and activates the home position switch. See Fig. 1.12.

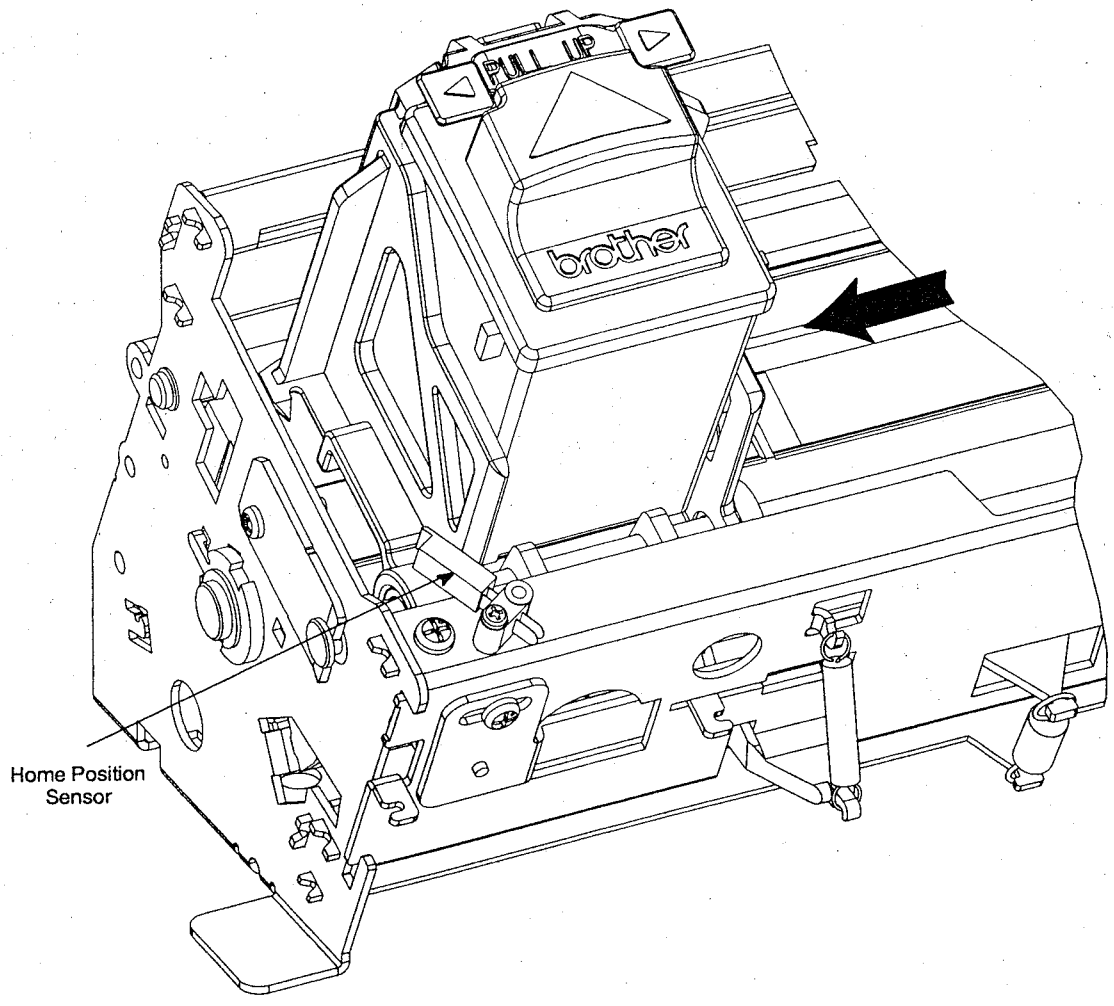

Fig. 1.12 – Carriage Home Position Sensor

Paper End Sensor

The paper end sensor detects when the trailing edge of the paper passes the paper end lever. The paper end sensor is an optical sensor. The lever pivots within the main paper pan, and acts as a "flag" to activate (open/close) the optical sensor circuit. See Fig. 1.13.

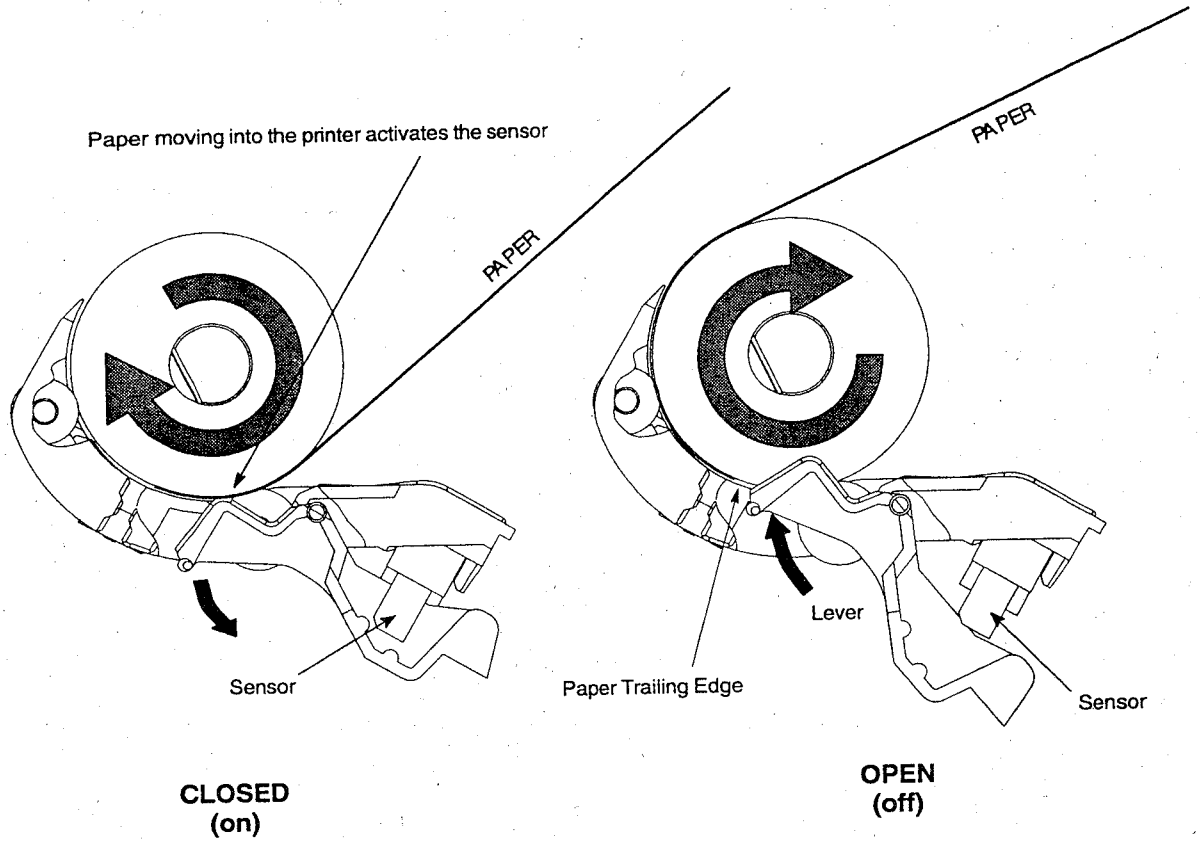

Fig. 1.13 – Paper End Sensor Mechanism

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1.3 INK CHG (Ink Change) Functions

There are two operator-initiated printer maintenance functions available from the keyboard: ink cartridge replacement and automatic printhead cleaning (purging).

1.3.1 Ink Cartridge Installation/Replacement

There is an ink cartridge installation/replacement function available from the keyboard. Pressing the key combination **CODE + INK CHG** moves the printhead from the maintenance station to the left end of the printer assembly. After installing or replacing the ink cartridge, pressing the RETURN key initializes the system: the carriage activates the home position sensor switch and sends the printhead back to the maintenance station. See Chapter 5, *Maintenance*, for ink cartridge replacement instructions.

1.3.2 Automatic Printhead Cleaning (Purging)

With the ink cartridge installed, pressing the key combination **CODE + SHIFT + INK CHG** initiates printhead purging. See Chapter 5, *Maintenance*, for manual printhead cleaning instructions.

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2. Keyboard

The keyboard assembly consists of the keyboard panel and keys, the FPC (flexible printed circuit) board, and the keyboard base plate. Fig. 1.15 shows the keyboard layout (key tops).

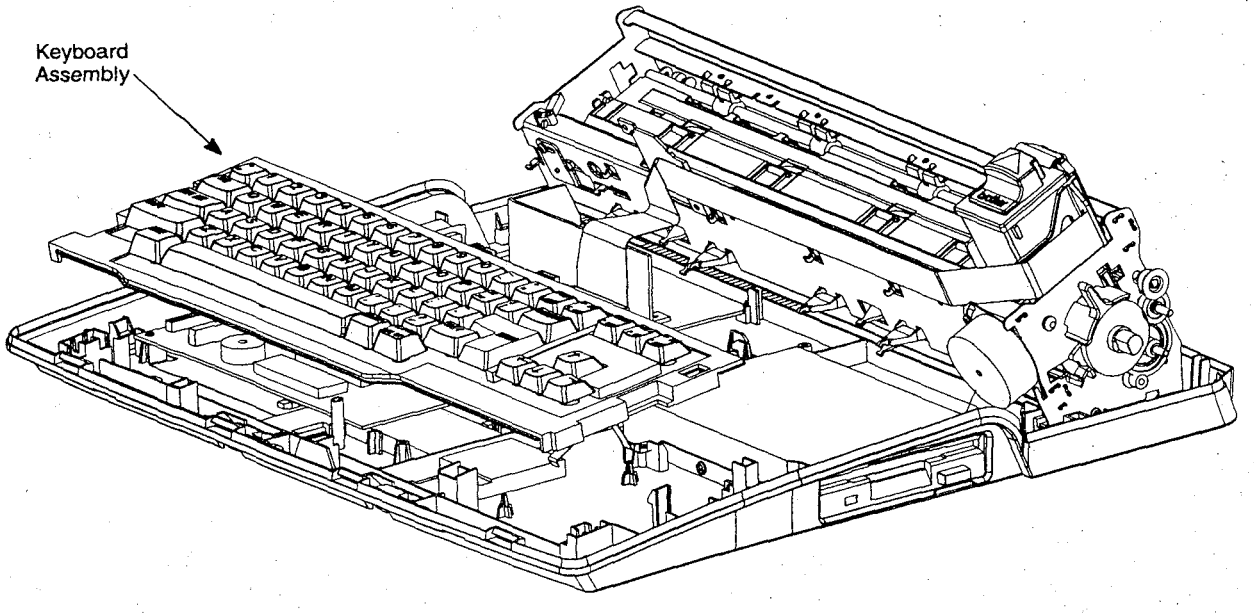

Fig. 1.14 – Keyboard Assembly

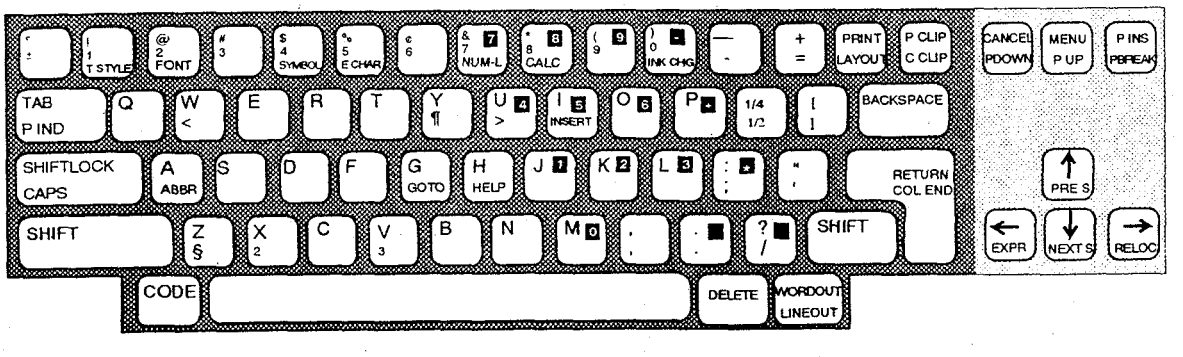

Fig. 1.15 – Keyboard Layout

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The key tops and key stems are assembled in the keyboard panel. The FPC (flexible printed circuit) board with rubber contacts is fitted to the base plate. See Fig. 1.16.

The FPC board is a single sheet of film (FPC) on which an electrode pattern is printed in layers. When the key top is pressed, the key actuator presses the rubber contact; the conductive part of the contact connects both of the electrodes to output the predetermined signal for the key.

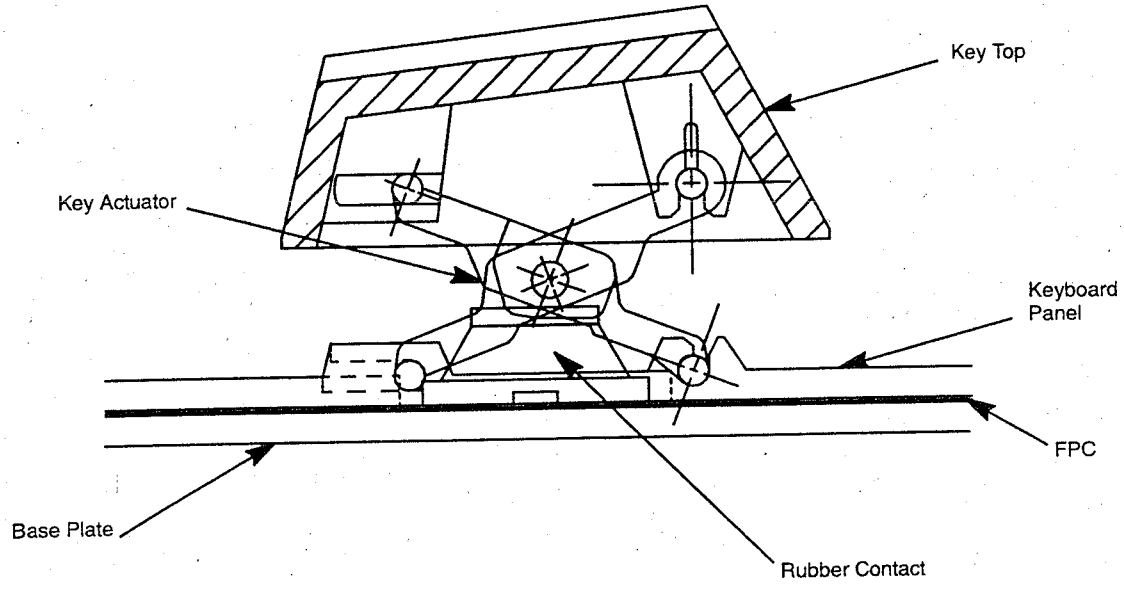

Fig. 1.16 – Key Top/Key Stem Assembly

3. LCD

The LCD (Liquid Crystal Display) is attached to the upper cover by a retaining pin at each end and the hinge tab that fits into a slot in the upper cover. The LCD can be tilted forward (from flat against the upper cover) to about 70° from the horizontal. The LCD hinge is a friction type that holds the LCD at whatever (tilt) angle is applied by the user. LCD contrast is controlled by a slider at the right side of the LCD upper cover. See Fig. 1.17 and Fig. 1.18. Models for Europe also have a backlit PCB. See Fig. 1.19.

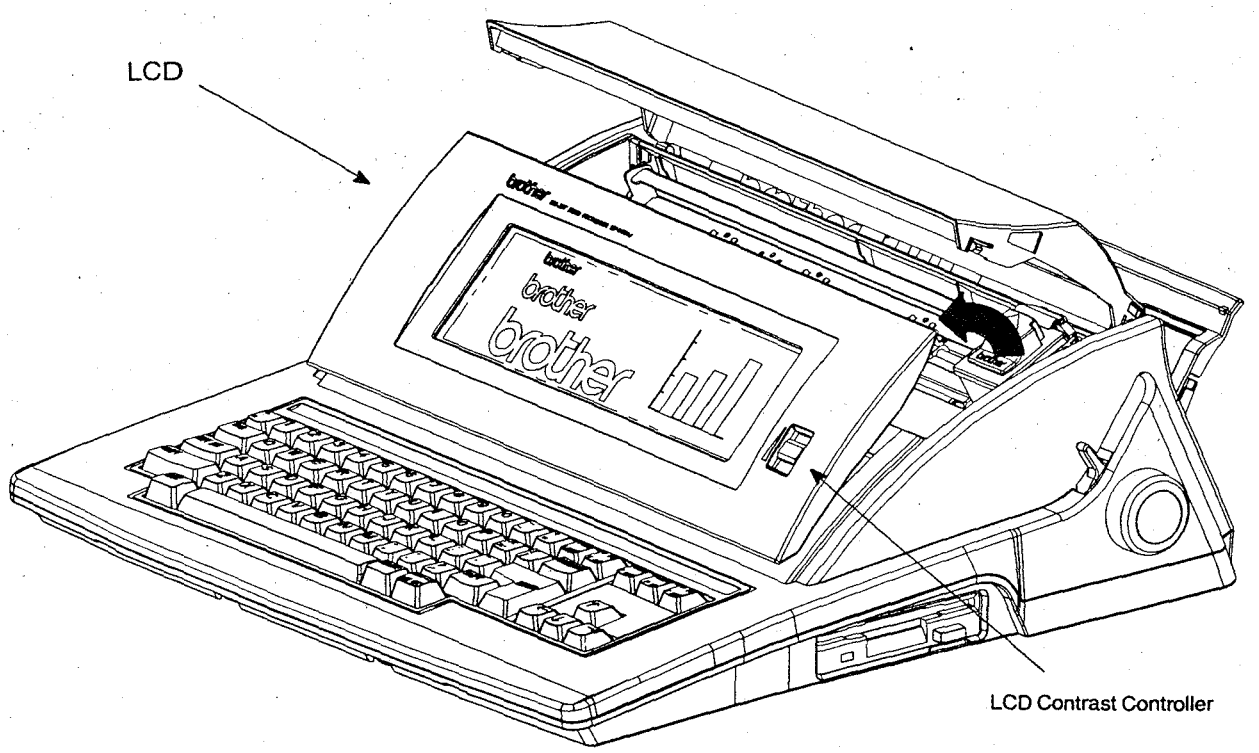

Fig. 1.17 – LCD Mechanism

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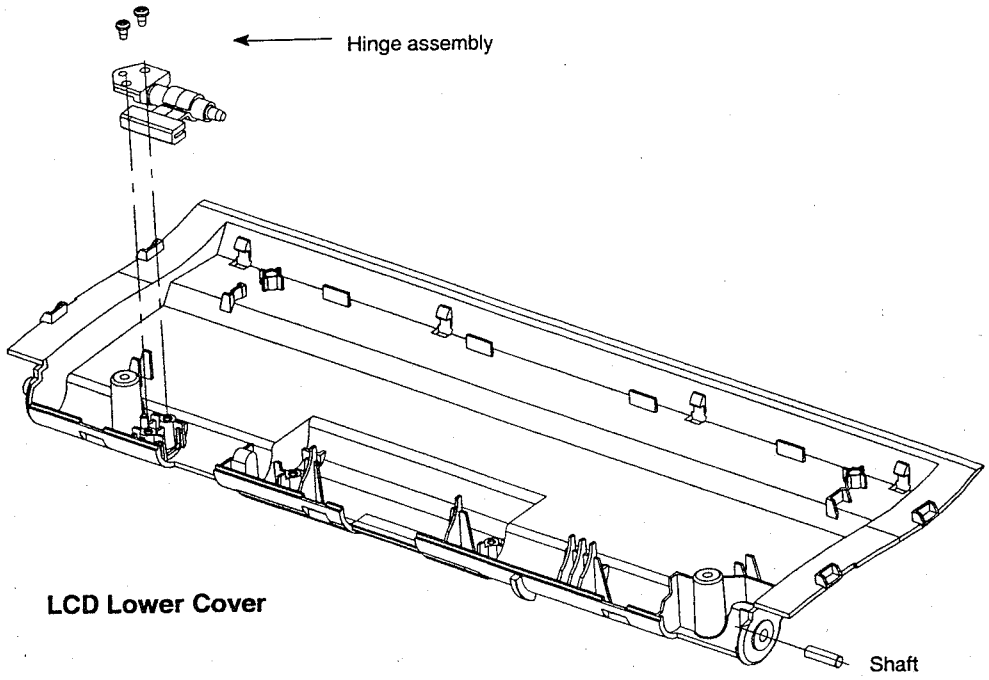
Fig. 1.18 – LCD Tilt Mechanism



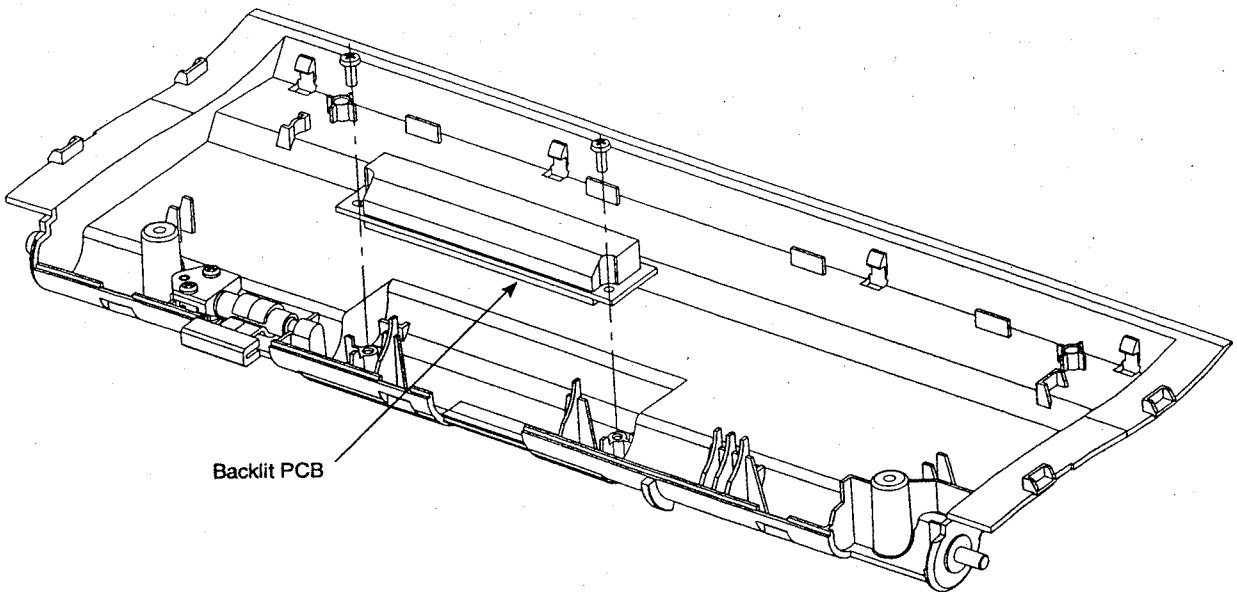


Fig. 1.19 – LCD with Backlit PCB (Europe only)

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4. ACF (Auto Cut-Sheet Feeder)

The ACF uses a friction drive and friction retard (separator) pad system whose operation is controlled by the friction materials for the drive roller and retard pad, and the "nip" forces applied by the hopper plate and bottom separator springs. The balance between the hopper plate and bottom separator spring forces is designed to optimize feeding while minimizing the force needed by the printer to feed paper to the print area. The feed rollers are situated to allow for feeding of letter, A4, and postal card size sheets of paper. Paper is loaded against a fixed registration edge and secured by an adjustable side guide, which minimizes skewing during feeding. The front tray provides for stacking/storing of printed sheets, and holds the same number of sheets as the paper tray. The wire supports can be removed to allow for loading accessibility or storage of the machine.

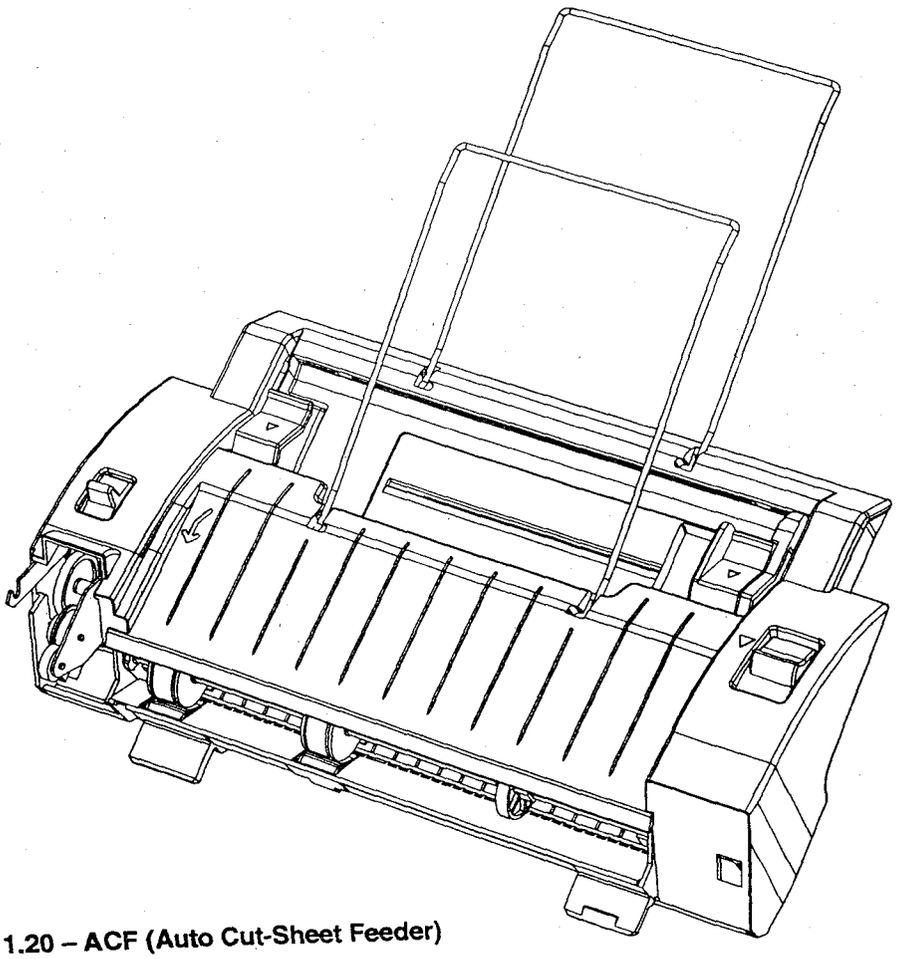

Fig. 1.20 – ACF (Auto Cut-Sheet Feeder)

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CHAPTER 2 Electrical Theory

1. System Configuration

The major electronic components of the word processor are shown in Fig. 2.1.

1.1 Power Supply PCB (printed circuit board)

The power supply PCB receives 11.5 VDC power, converts it to +24 VDC, +5 VDC, +8 VDC (Europe), and supplies it to the Main PCB.

1.2 Keyboard PCB (FPC: Flexible Printed Circuit)

The keyboard PCB has electrodes arranged in the matrix circuit pattern. The keyboard status is sent from the PCB to the Main PCB.

1.3 Main PCB (printed circuit board)

The Main PCB is controls the entire the word processor system including the LCD display, the ink cartridge, and the motors in the printer.

The +24 VDC from the power supply PCB drives the ink cartridge and motors in the printer. The CPU and other devices are driven by +5 VDC.

1.4 FDD (floppy disk drive) Module

The FDD can read and write information supplied to the Main PCB. The FDD is driven by +5 VDC.

1.5 LCD Module (Liquid Crystal Display)

The LCD PCB contains the driver for the dot matrix of the LCD on which various information is displayed. The optional "Backlight" (European models only) is driven by +8 VDC from the Main PCB.

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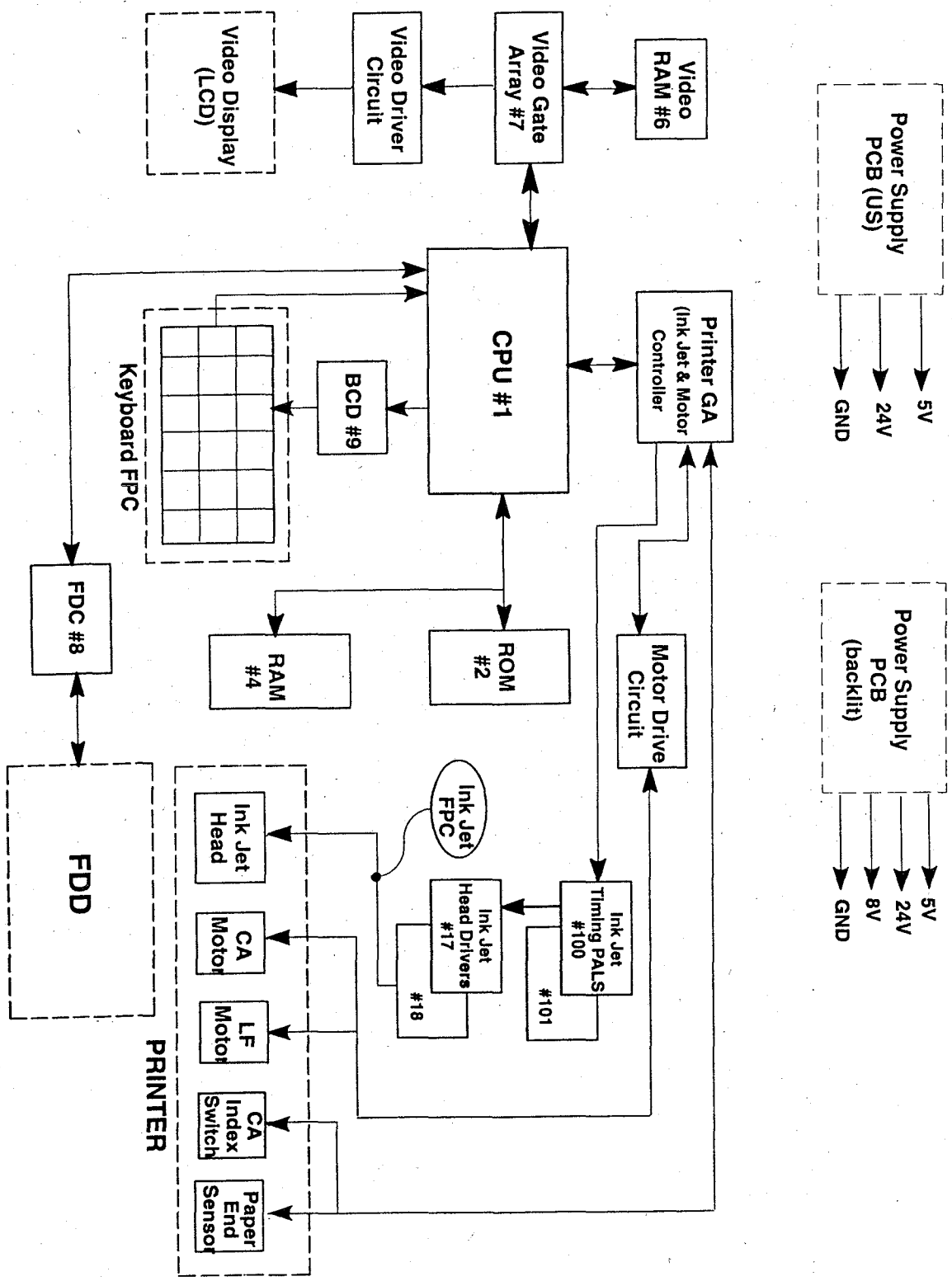

Fig. 2.1
WP- 6400/6500J – Major Electrical Components

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2. Ink Jet Printer Configuration

The following describes the operation of the ink cartridge, motors, and other components.

2.1 Ink Cartridge

The ink cartridge contains the 56-nozzle ink jet head which has a resolution of 300 DPI.

2.2 Carriage Motor

The carriage step motor drives the carriage to the left and right with precision motion control.

2.3 Line Feed Motor

The line feed motor feeds the paper forward and reverse. It also drives the optional Auto Cut-Sheet Feeder mechanism.

2.4 Carriage Index (Home Position) Sensor

The carriage index sensor is mounted to the left end of the front printer frame. It detects the carriage home position to synchronizing position of the carriage and motor phasing.

2.5 Paper–end Sensor

The paper end sensor detects whether or not paper is in the printer. The paper-end sensor is located on the bottom of the main paper pan at the left rear of the printer assembly.

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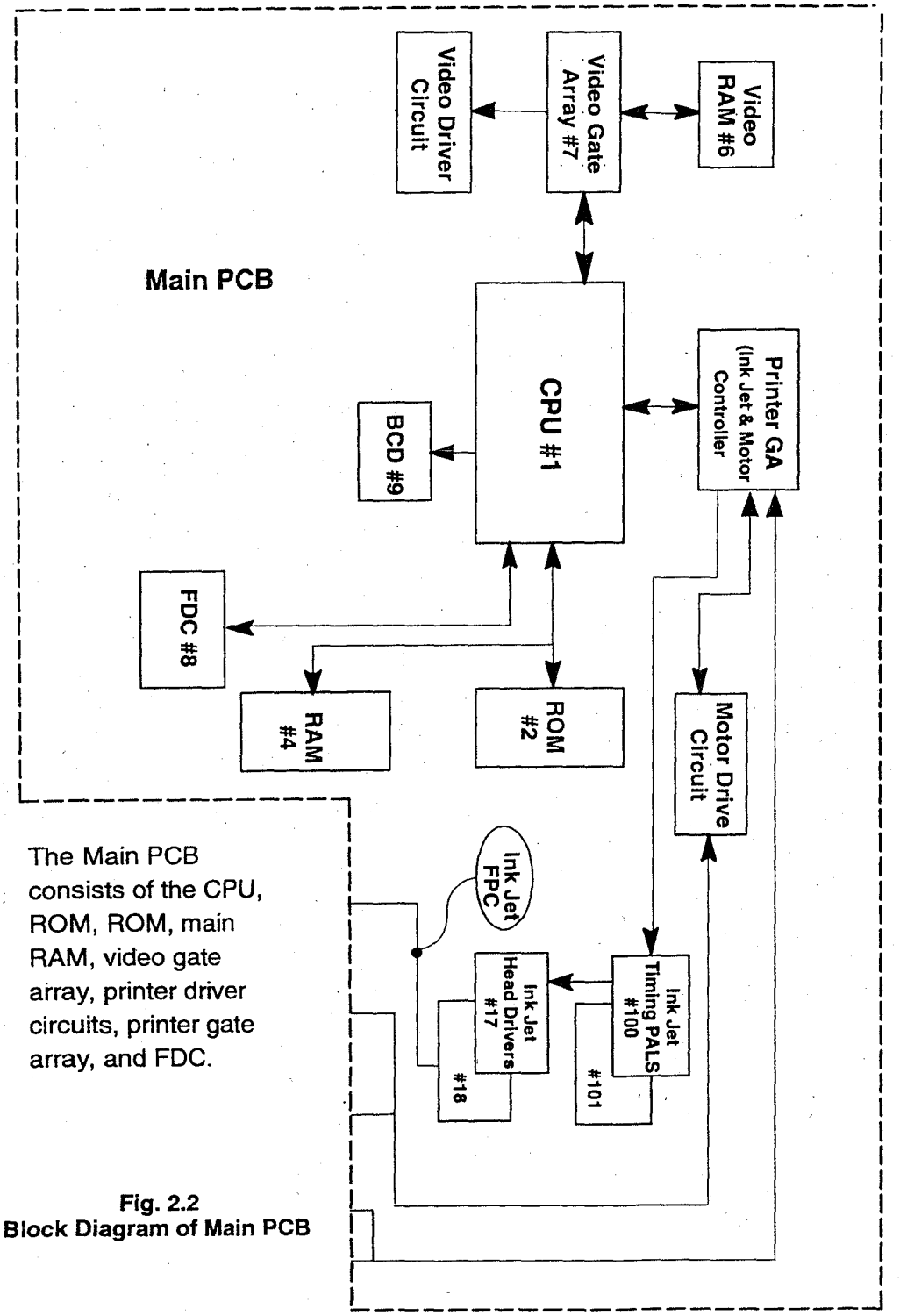
3. Main PCB and Peripherals



The Main PCB consists of the CPU, ROM, ROM, main RAM, video gate array, printer driver circuits, printer gate array, and FDC.

Fig. 2.2
Block Diagram of Main PCB

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3.1 CPU PCB

The CPU PCB controls the word processor system, and is directly connected to the keyboard and the FDC.

It communicates with the video gate array and the printer gate array to control the video output and printer functions, respectively.

3.2 ROM1 #1

The capacity of ROM1 is determined by the presence or absence of solder point SP12. When SP12 is open, ROM1 has a capacity of 16 Mbits and stores the program, dictionary, and font data. When SP12 is closed, ROM1 has a capacity of 8 Mbits and stores the program only.

3.3 ROM2 #2 (if present)

The capacity of ROM2 is determined by the presence or absence of solder point SP11. When SP11 is open, ROM2 has a capacity of 8 Mbits and stores the font data. When SP11 is closed, ROM2 has a capacity of 16 Mbits and stores the font data and the demonstration program.

3.4 Main RAM (Random Access Memory)

In the main RAM, 2 Mbits PSRAM (#4, #6) is used to provide the 256K bytes used as the CPU's working area, and for storage of the LCD video display area.

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3.5 Video Gate Array

The video gate array is an IC (integrated circuit) incorporating the circuit which generates bus control signals by receiving signals from the CPU and the LCD control circuit (see Fig. 2.2). Solder point SP8 is not used with LCD modules. However, solder point SP10 is used to change the LCD data reverse, and solder point SP13 (M10T) is used to change the LCD M signal frequency.

Debug 1, Debug 0 Locations	(H, H)	(H, L)	(L, H)	
000000H ▼ 1FFFFFH	CE1 2 MB max	CE1 2 MB max	CE1 1 MB max	ROM area
			CE2 1 MB max	
200000H ▼ 3FFFFFH	CE3 2 MB max	CE2 1 MB max	CE3 2 MB max	
		CE3 1 MB max		

Table 2.1 – Video Gate Array Address Map (ROM area)

3.6 Printer Driver Circuits (Head & Motors – #100, #101, #17, #18, #16, Q1–4)

The printer driver circuits convert the motor phase drive signals' output from the printer gate array (#13B) to +24V drive signals, which are output to the motors and the ink cartridge. IC #15 provides feedback to the printer gate array to maintain constant current to the carriage motor.

3.7 Printer Gate Array

The printer gate array controls all printer functions, including both carriage and line feed motors, and the ink jet printhead (nozzle selection) signals. It also informs the CPU of the carriage index switch and the paper-end sensor signals. See Fig. 2.3.

3.8 FDC (Floppy disk Controller)

The FDC controls floppy disk drive access through the FDD drive circuit.

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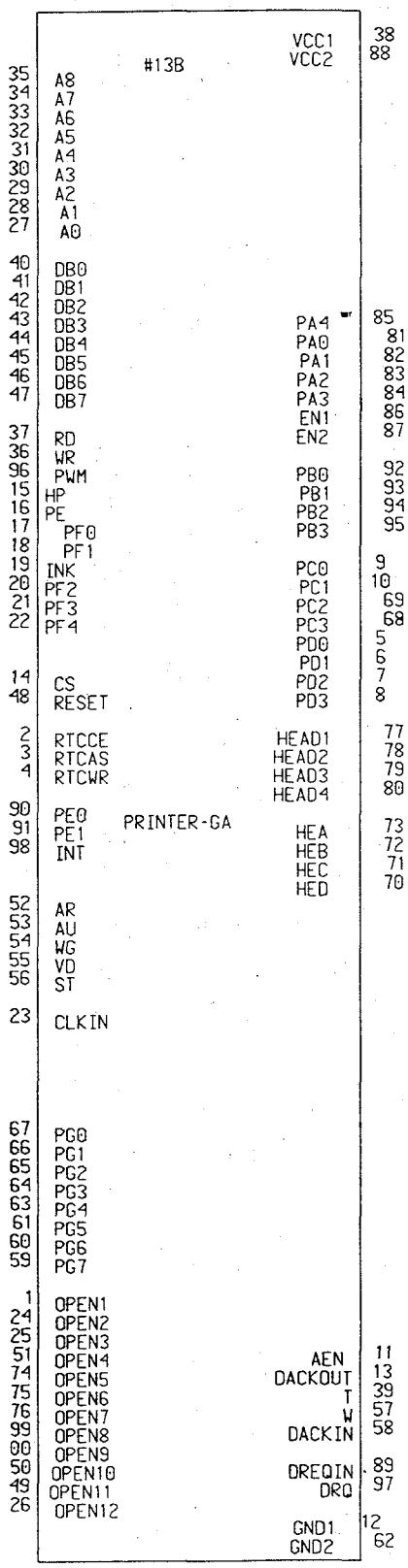
Fig. 2.3 – Printer Gate Array (#13B)



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3.9 Clock Circuit

Four different clock circuits shown in Table 2.2 are incorporated into the Main PCB.

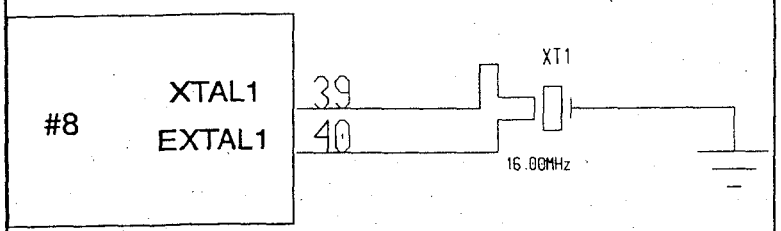
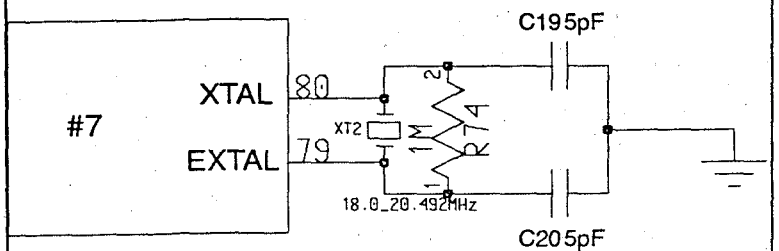
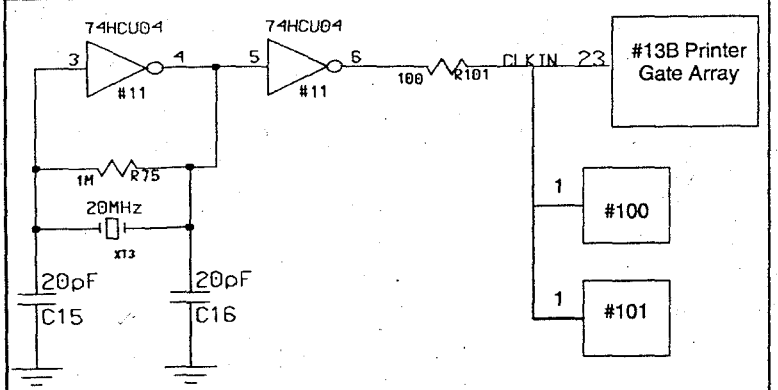
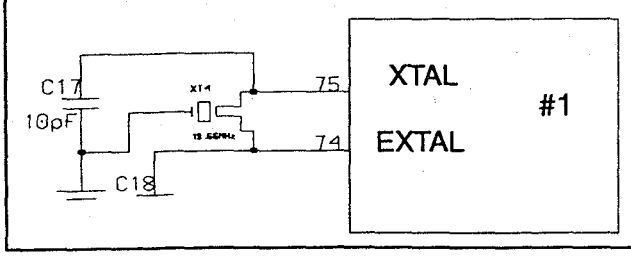
Clock Circuit	Frequency	Function
	16 MHz	XT1 is the standard clock for FDD control; it inputs for #8 (pins 39, 40).
	18 MHz	XT2 is the standard clock for CRT control; it inputs for #7 (pins 79. 80).
	20 MHz	XT3 is the standard clock for printer control and printhead timing; it inputs for #13B (pin 23), #100 (pin 1), and #101 (pin 1).
	19.66 MHz	XT4 is the CPU oscillation clock; it inputs for #1 (pins 74, 75).

Table 2.2 – Clock Circuits

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3.10 Reset Circuit

The reset circuit delays the system from starting while the voltage to the system stabilizes. It also allows the system to restart from a known state. The reset circuit causes a system delay of 80 - 150 ms upon initial power-up. See Fig. 2.4.

The following devices (and their pins) are attached to the reset line:

Device	Pin
CPU (#1)	71
VGA (#7)	77
PGA #13B)	48
Printer Drivers (#17, #18)	5

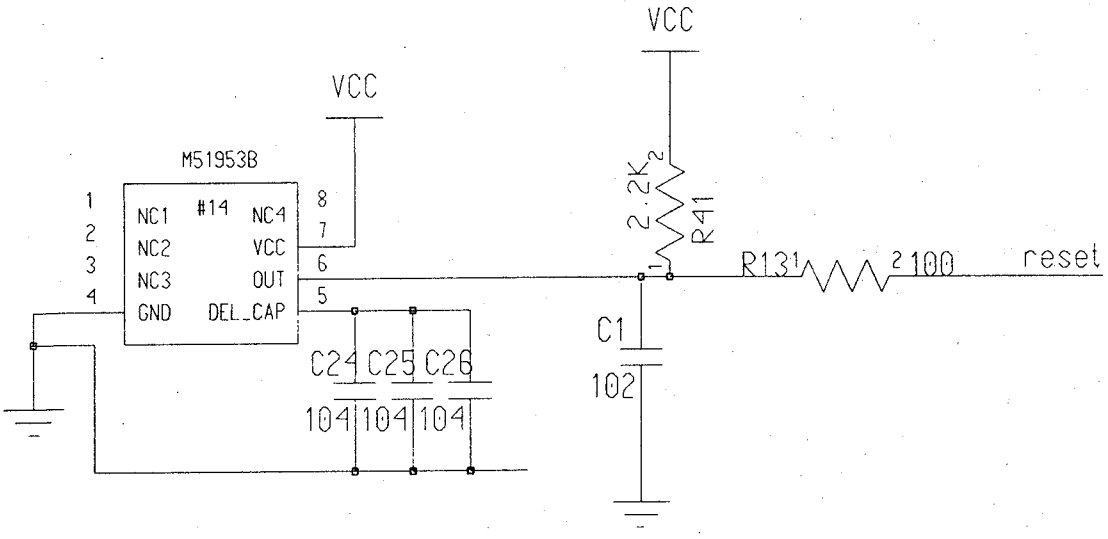

Fig. 2.4 – Reset Circuit

3.11 Buzzer Drive Circuit

The buzzer drive circuit is shown in Fig. 2.5. A 4 kHz pulse of 50% duty is output from port PA2 (Pin 107) of CPU (#1) when buzzer operation is needed.

The piezoelectric element in BZI generates sound on reception of this pulse. The output from port PA2 is HIGH when the buzzer is not in operation.

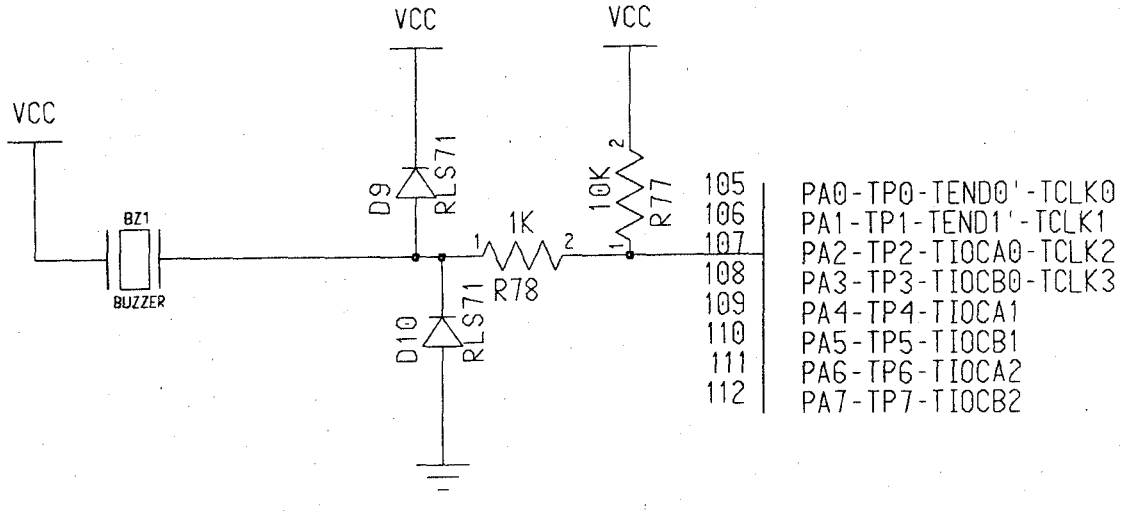

Fig. 2.5 – Buzzer Drive Circuit

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3.12 Memory Map

The CPU (H8/3003) has 24 address lines. The lower address lines are used to access the system ROM and RAM, while the upper address lines access the video and printer gate arrays, as well as the internal CPU registers and RAM.

ADDRESS	DESCRIPTION	
400000H	(not used)	RAM area
408000H		
600000H	RAM1 128 KB	
620000H	RAM3 128 KB (work area & Video RAM)	
640000H	not used	
E00000H	LCD Gate Array (internal register) See Table 2.4.	I/O area
F00000H	Printer Gate Array select	
FFFD10H	CPU internal RAM area	
FFFF10H	Printer Gate Array select	
FFFF1CH	CPU internal I/O register	
FFFFFFH		

Table 2.3 – LCD Address Map (RAM and I/O areas)

3.13 I/O Map

CPU #1 has a 64K byte I/O area in addition to a 512K byte memory area. Addresses 0000H to 003FH are used as an internal CPU I/O area. The following external I/O areas are controlled by the LCD gate array:

- FDC
- VRAM area
- LCD refresh
- LCD pulse & M frequencies
- Horizontal character
- LCD data & pulse output

These external I/O areas are enabled by outputting the address bus signals as shown in Table 2.4.

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Addresses	LCD Gate Array (internal register)	
	Decode Name	Function
EXXX0XH	FDC	Decode out.
EXXX1XH	Not applicable	Not used.
EXXX2XH	Not applicable.	Not used.
EXXX30H	CSCLK	Set the LCD refresh cycle.
EXXX32H	CSPLS	Set the frequency of PULSE and M signal.
EXXX34H	CSVA	Set the starting address of VRAM.
EXXX36H	CSCC	Set the Horizontal Character.
EXXX38H	Not applicable.	Not used.
EXXX3AH	Not applicable.	Not used.
EXXX3CH	Not applicable.	Not used.
EXXX3EH	Not applicable.	Not used.
EXXX4XH	CSDAT	Control the Display DATA and PULSE output.
EXXX5XH	CSRES	When CPU operates this one, GA counters are reset.
EXXX6XH	CSTST	It is for GA simulation; CPU cannot operate this one.
EXXX7XH	Not applicable.	Not used.

Table 2.4 – LCD Gate Array I/O Map

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3.14 Country Specification Change-over

The country specification change-over circuit is shown in Fig. 2.6. The country specification is recognized by the CPU by sensing solder on the solder points. Table 2.5 shows the solder points used for changing the country code.

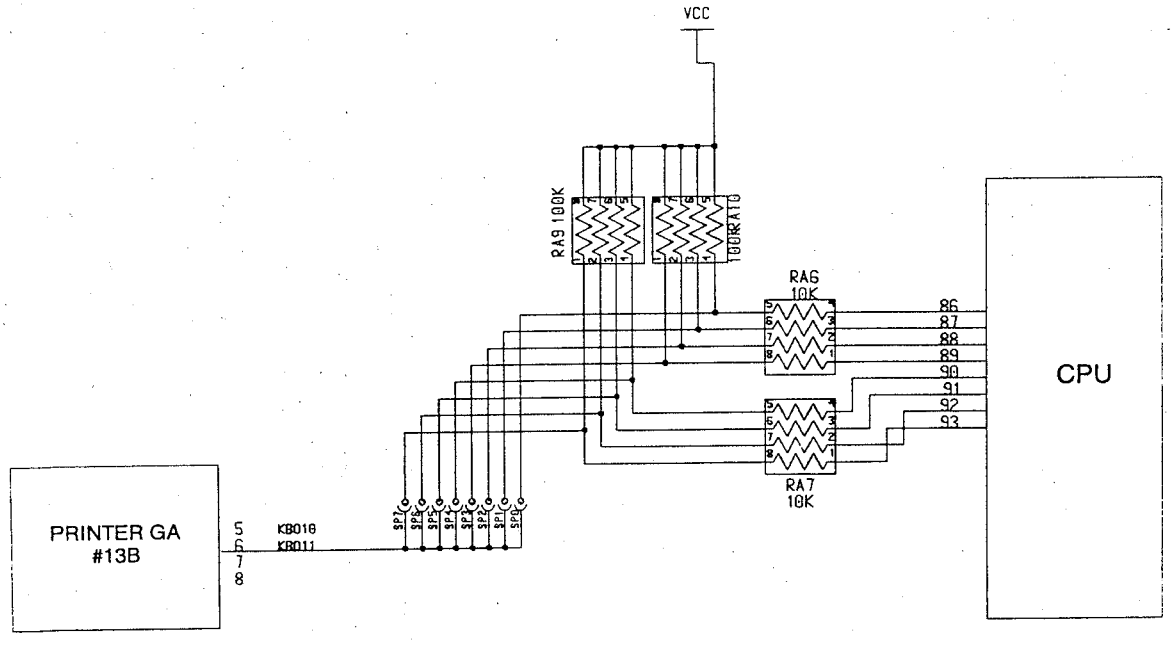

Fig. 2.6 – Country & Model Specification Change-Over Circuit

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MODEL	COUNTRY	SOLDER POINTS					
		S0	S1	S2	S3	S4	S9
WP-6400J	USA (Mass)						X
	USA (Protected)						
	USA (Protected/A4*)	X					
WP-6500J	CANADA			X			
	MEXICO						
	CHILE	X					
	BRAZIL	X					
	NEW ZEALAND						
	SINGAPORE						
LW-700i w/o backlight	UK (incl Ireland)						
	GERMANY	X					
	AUSTRIA		X				
	FRANCE						
	FINLAND		X				
LW-710i w/backlight	FRANCE, SWITZERLAND, HOLLAND						
	BELGIUM	X					
2000i (Privileg)	GERMANY	X					
* Australia	X = solder connection present at SP						

Table 2.5 – Country Code Solder Points

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3.15 ROM Configuration Mode Change-Over

The ROM configuration change-over circuit is shown in Fig. 2.7. The decoding area for chip selection signal (CS) ROM1 is determined by the presence or absence of solder at solder point SP12. The decoding area for ROM2 is determined by the presence or absence of solder at solder point SP11.

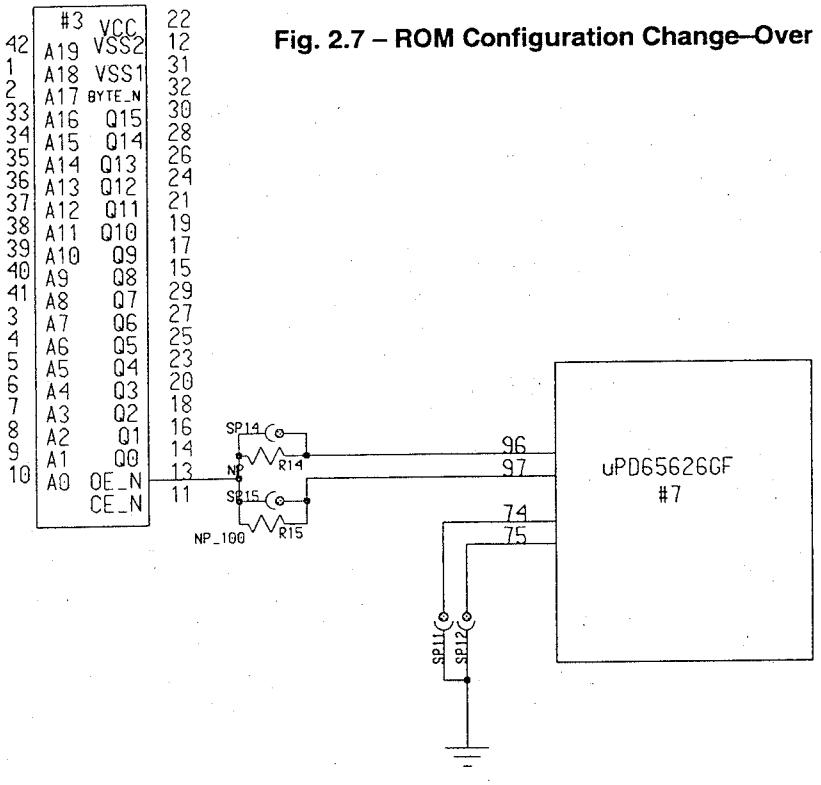

Fig. 2.7 – ROM Configuration Change–Over Circuit

ROM1 CS ("Chip Select") is enabled from pin 95 of the video gate array (#7). ROM2 CS is enabled from pin 96 of the video gate array, and SP14 must be soldered or resistor R14 must be in place to activate. ROM3 CS is enabled from pin 97 of the video gate array, and SP 15 must be soldered or resistor R15 must be in place to activate. Table 2.6 shows the ROM mounting state for each of these cases.

PG-0 is used to adjust the alignment for bi-directional printing; this adjustment, if necessary, may be accomplished with DIP switches or with solder points 17–20. The pull down resistors in PG4 through PG7 ports of printer GA (GA2) are used for changing the mode.

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Ports	Function
PG-0, PG-1, PG-2, PG-3	Reserved (adjustment for tolerance of bi-directional printing
PG-4	Reserved
PG-5	Paper feed power up: "HIGH" (without resistor) – normal "LOW" (with resistor) – additional torque
PG-6	Carriage motion power up: "HIGH" (without resistor) – normal "LOW" (with resistor) – additional torque
PG-7	ROM access speed: "HIGH" (without resistor) – 3 state with 0 wait "LOW" (with resistor) – 3 state with 1 wait

Table 2.6 – ROM Mode Change-over Jumper Configuration

4. Printer Control

4.1 Ink Jet Head Control

The ink jet head drive circuit is shown in Fig. 2.8. The ink jet head has 50 active nozzles (monochrome). Two multiplexing current drive circuits (#17, 18) address the nozzles to perform printing. Custom circuitry controls the timing and synchronization to fire the ink as the carriage moves across the paper in printing. The same system controls maintenance spitting into the trough as needed.

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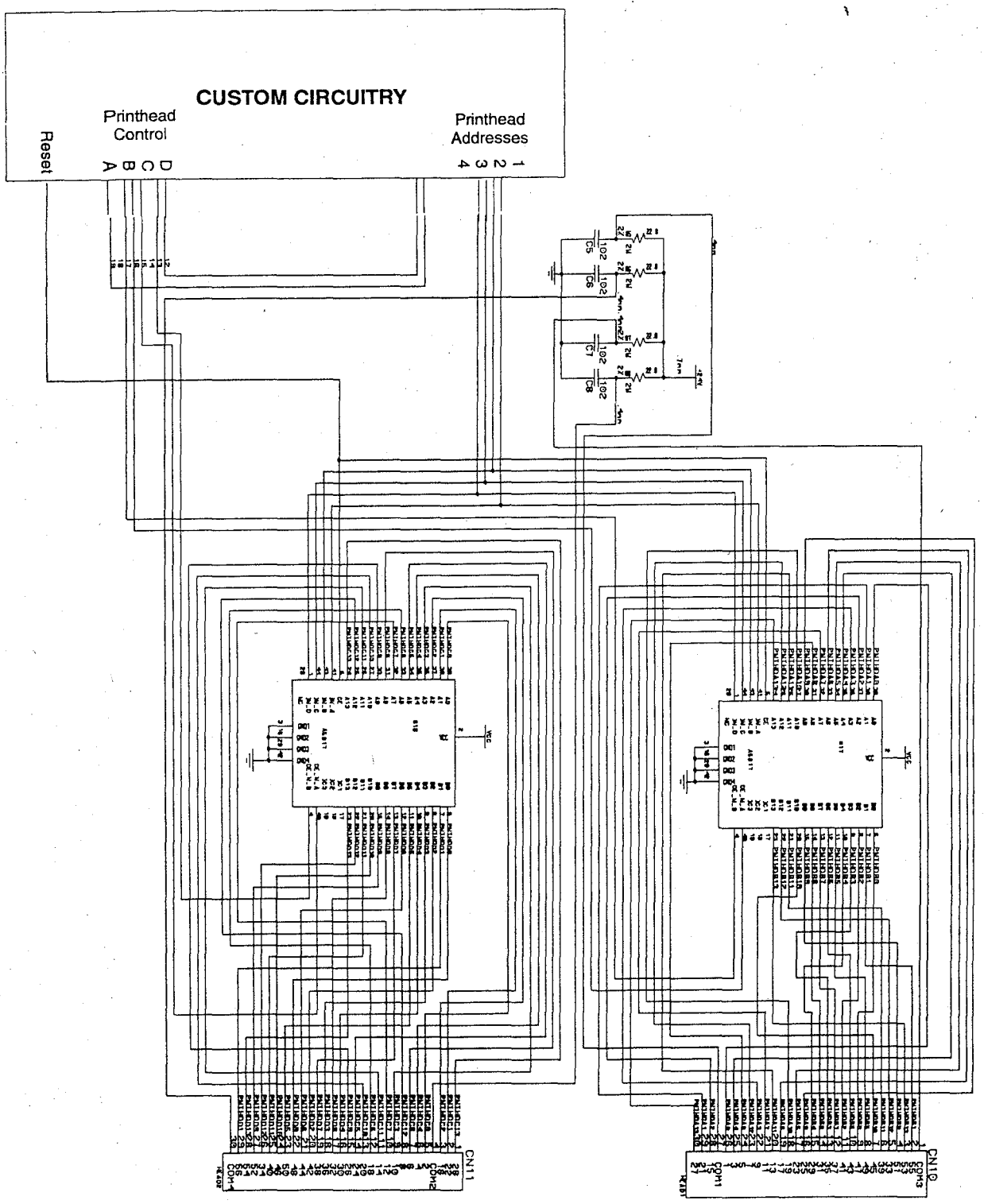

Fig. 2.8 – Ink Jet Head Drive Circuit

4.2 Carriage Motor Control

The carriage motor control circuit is shown in Fig. 2.9. +24 VDC is applied to the motor through connector CN17 (CNCA), pins 5 and 6. Motor phases A, B, C, and D are driven by the printer gate array (#13B) through pins 81 – 84, respectively. The outputs of the printer gate array turn transistors Q1 – Q4 on and off, which in turn affect the motor phases.

During printing, the current through the motor phases is maintained at 400mA per phase, by feeding the voltage through each phase into resistor R9 or R10 (1Ω). The result of this is to create a voltage-to-current transformation (i.e., 1V = 1A).

This transformed current is then fed into a comparator (#15 *or* #300) and compared to a 400mV (i.e. 400mA) reference signal generated by voltage dividers R11 and R35, or R12 and R40. If the current is greater than 400mA, the comparitor outputs a pulse to the printer gate array (pin 86 or 87). The printer gate array then "chops" the phase until the current drops below 400mA. This cycle continues until the motor phase changes, and repeats for each phase until the motor is stopped.

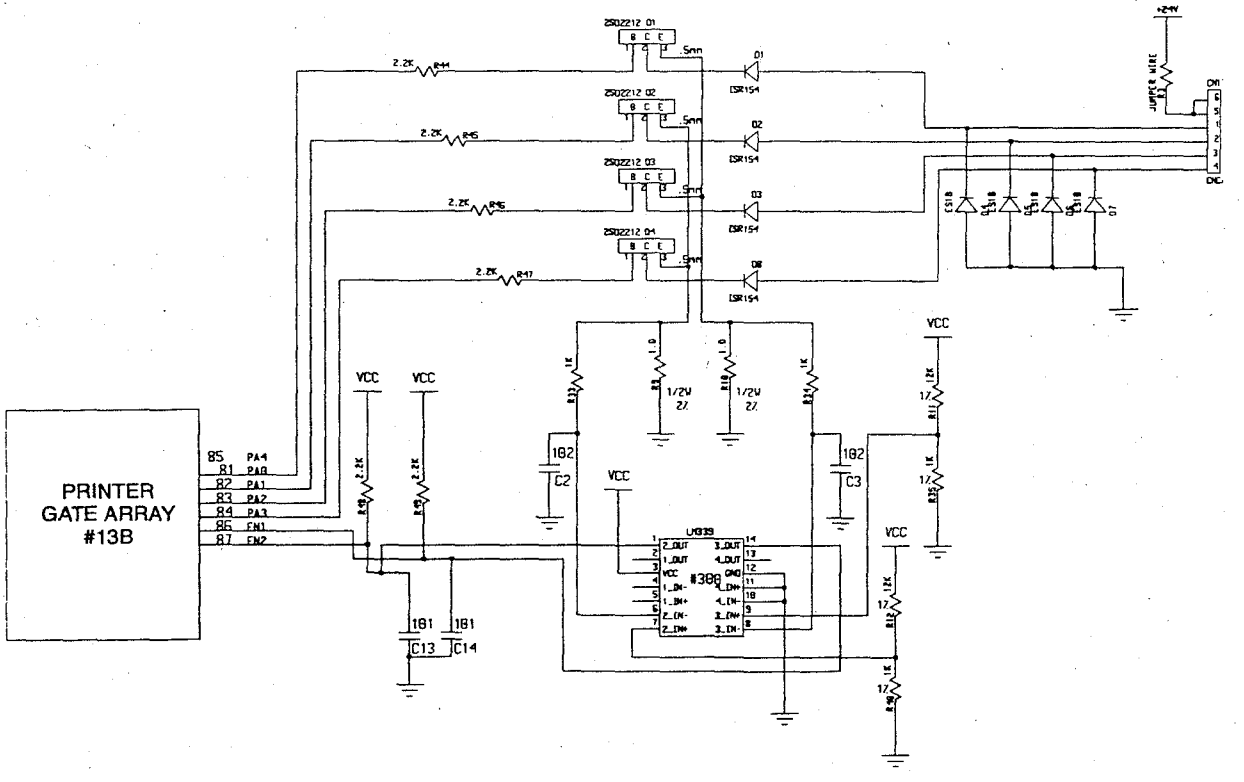

Fig. 2.9 – Carriage Motor Control Circuit

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4.3 Line Feed Motor Control

The line feed motor drive circuit is shown in Fig. 2.10. The line feed motor is powered by +24 VDC. Each of the 4 phases of the motor are excited when CPU #1, via ports BO–B3, of the printer gate array (#13B) outputs to turn on the transistors of transistor array #16.

This provides a path to ground through the transistor, which allows current to flow. When the printer gate array outputs a LOW, the transistor remains off (current does not flow, and the motor remains off).

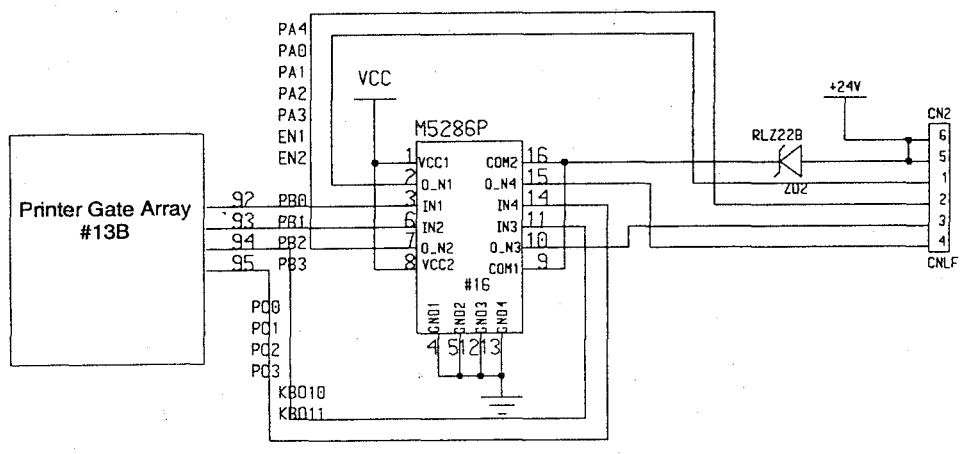

Fig. 2.10 – Line Feed Motor Drive Circuit

4.4 Carriage Index (Home Position) Sensor

The carriage home position sensor circuit is shown in Fig. 2.11. The sensor condition is read by printer gate array (#13B) (pin 15) and a LOW is detected when the carrier reaches the home position.

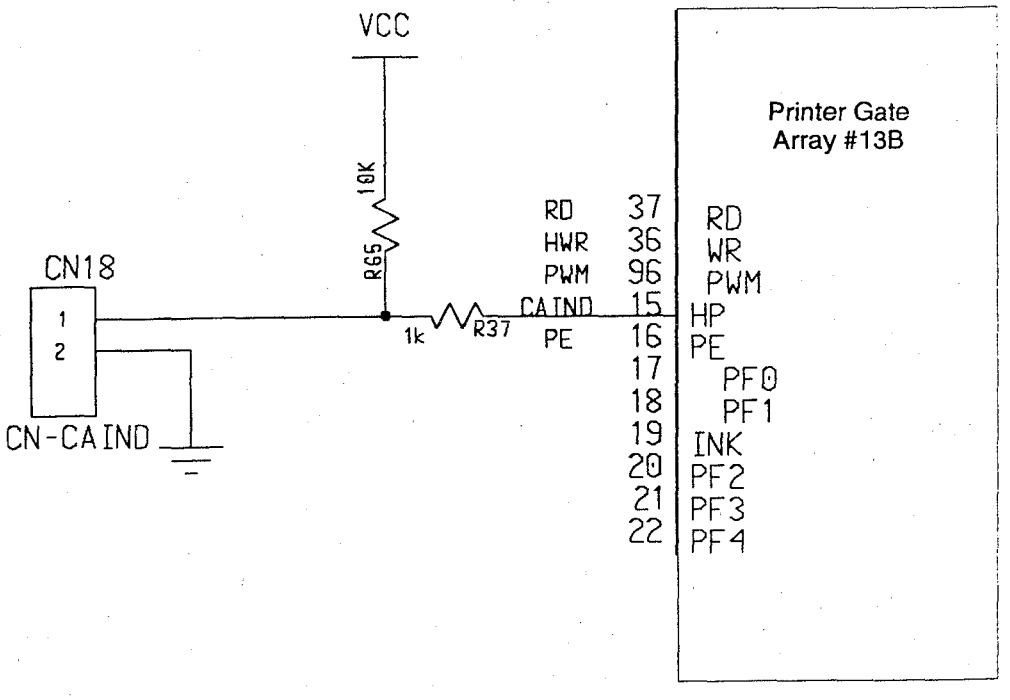

Fig. 2.11 – Carriage Index Sensor Circuit

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4.5 Paper-End Sensor

The paper end sensor detection circuit is shown in Fig. 2.12. The HIGH/LOW status of the paper-end sensor is read by printer gate array (#13B) (pin 16); a HIGH is output if there is no paper at the sensor position.

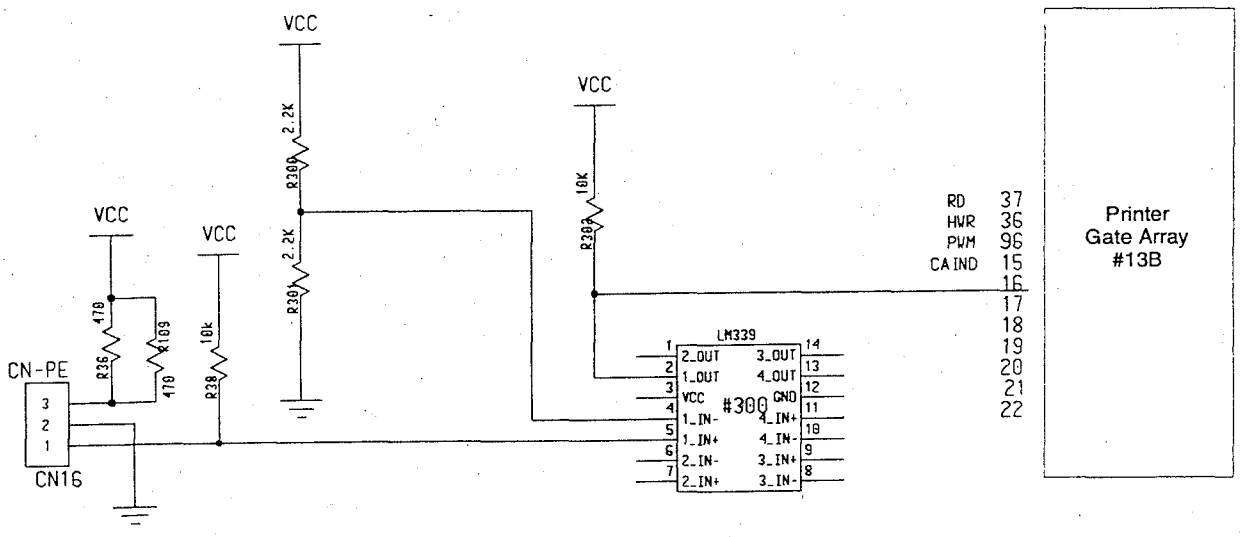

Fig. 2.12 – Paper–end Sensor Detection Circuit

5. Keyboard PCB

5.1 FPC Operation

The keyboard is a flexible printed circuit (FPC) board on which the circuit pattern and electrodes are printed. When a key is pressed, the key stem is forced down until the carbon-type conductive silicon rubber makes contact with the FPC electrode and electricity is conducted. See Fig. 2.13.

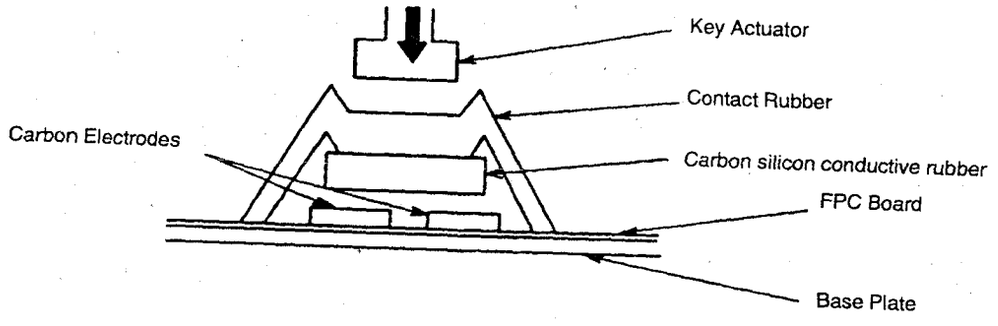

Fig. 2.13 – Key/FPC Operation

5.2 Keyboard Scan

Fig. 2.14 shows the pattern from wiring electrodes on the board (this figure shows only simplified wiring for ease of explanation and is slightly different from the actual wiring). Refer to Fig. 2.14 to understand the keyboard scanning operation described. When a key is not pressed, continuity does not exist in any combination on the matrix (e.g. XI and Y1 or X1 and Y2). For example, if Key (A) is pressed, continuity will exist only in X2 and Y3, but not between any other pair of points which are left in the OFF status. In other words, if continuity exists between X2 and Y3, it means that Key (A) is being pressed.

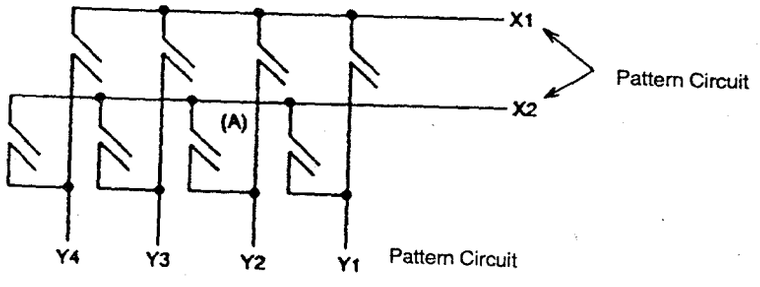

Fig. 2.14 – Electrode Wiring

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5.3 Keyboard Control Circuit

The matrix pattern on the keyboard PCB controls port 7 (0:7) of CPU#1 according to data signals PB0 through PB3 of the CPU (#1) (see Fig. 2.15). The LOW level signals are output to output lines KO0 through KO9. The electrode wiring is scanned line by line beginning with Y0. The result of scanning is input to K10 through K17 of CPU (#1). CPU (#1) detects which key has been pressed. The key matrix given shown in Fig. 2.16 corresponds to the key arrangement shown in Fig. 2.17.

Fig. 2.15 – Keyboard Circuit

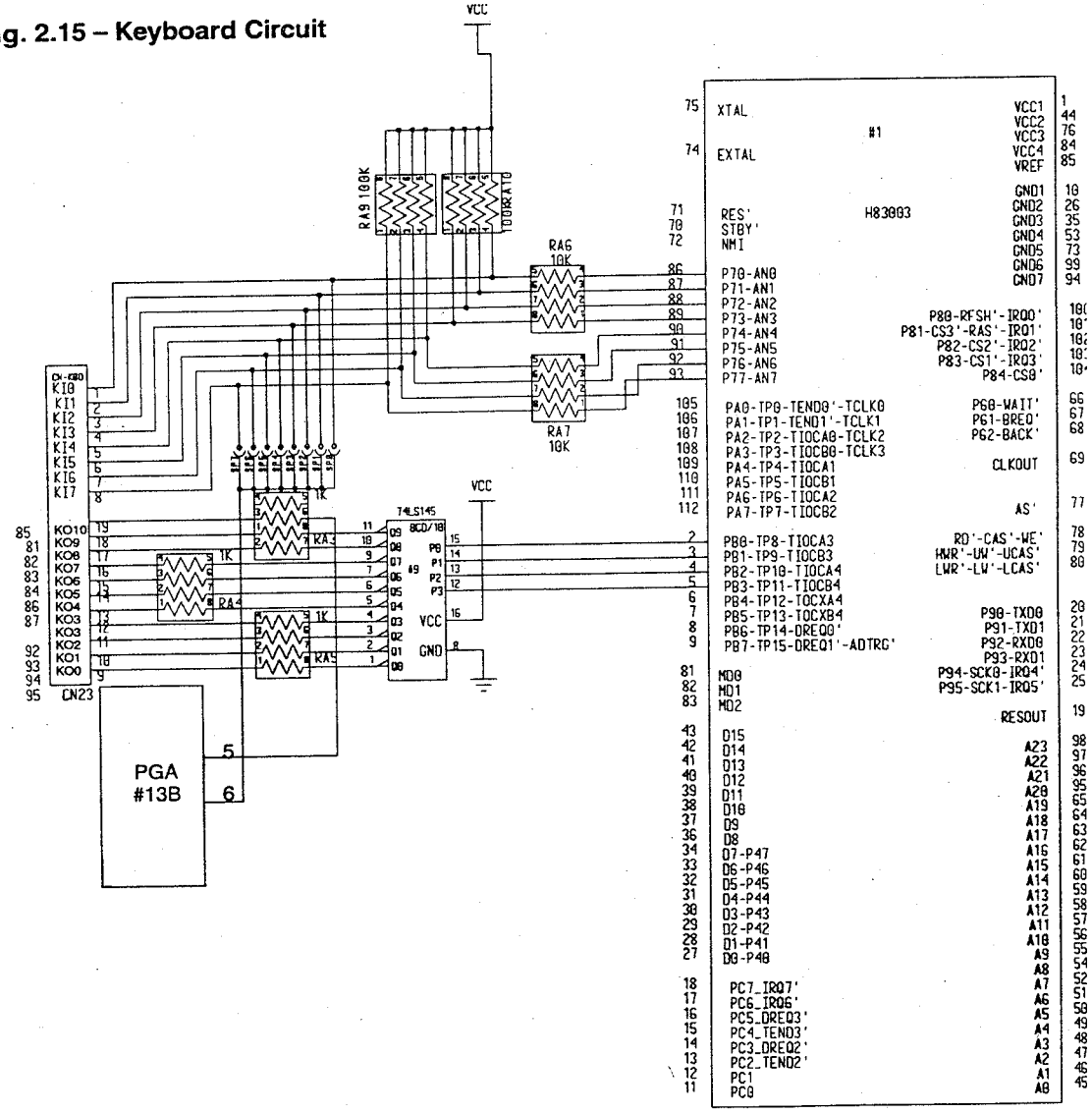

Fig. 2.16 – Keyboard Matrix

pin NO	9	10	11	12	13	14	15	16	17
1	A4	A5	A8	A1	A9	A11	F2	F1	A12
2	A3	A6	A7	A2	A29	A10	AA3	F3	A31
3	A14	A16	A18	A13	A20	A22	AA2	F9	A0
4	A15	A17	A28	A32	A19	A21	AA1	F7	A30
5	A25	A34	A27	A23	A36	A38	F12	F17	A40
6	A33	A26	A35	A24	A37	A39	F13	F18	A41
7		F19	F21		F20		F15	F16	AA4
8	F6	F10	F5	F8	F14	F4		F11	

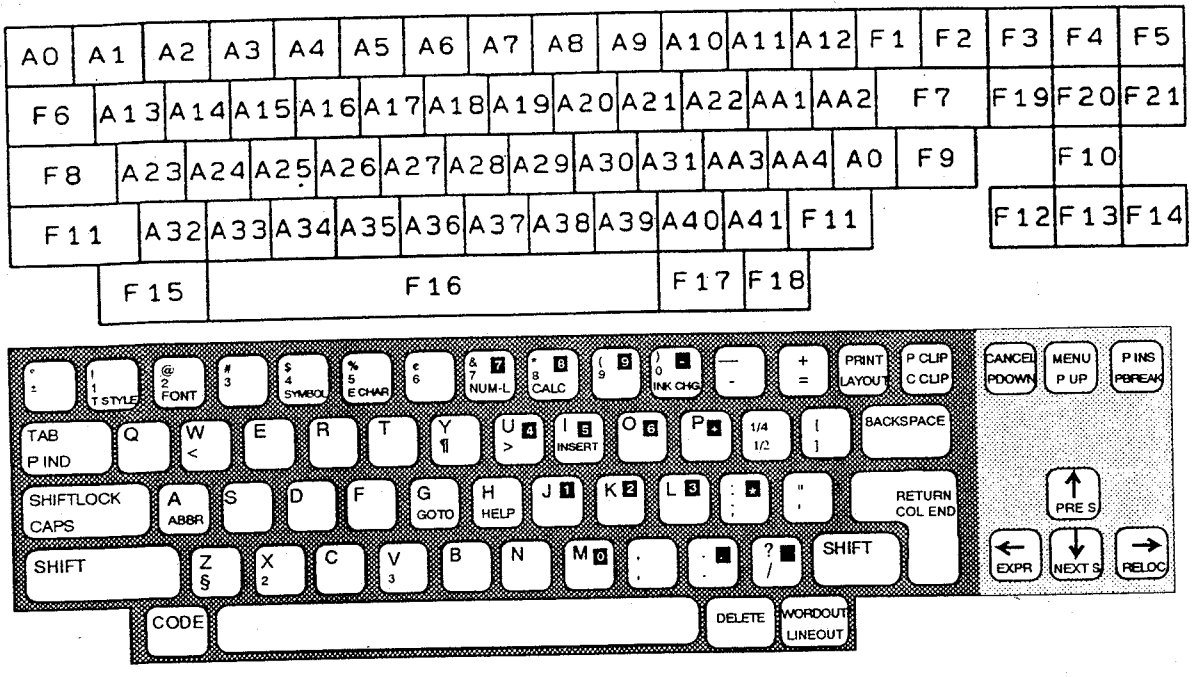
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 F1 F2 F3 F4 F5
F6 A13 A14 A15 A16 A17 A18 A19 A20 A21 A22 AA1 AA2 F7 F19 F20 F21
F8 A23 A24 A25 A26 A27 A28 A29 A30 A31 AA3 AA4 A0 F9 F10
F11 A32 A33 A34 A35 A36 A37 A38 A39 A40 A41 F11 F12 F13 F14
F15 F16 F17 F18
TAB P IND
SHIFTLOCK CAPS
SHIFT
CODE
BACKSPACE
RETURN COL END
SHIFT
DELETE
WORDOUT LINEOUT
PRINT LAYOUT
P CLIP C CLIP
CANCEL PDOWN
MENU P UP
P INS PBREAK
PRE S
EXPR
NEXT S
RELOC

Fig. 2.17
Keyboard Symbols
(Corresponding to the Keyboard Matrix)

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6. LCD Module

The LCD operation depends on two sections: the LCD controller and the LCD module. The video gate array(#7) on the main PCB controls the contents to be displayed and sends signals to the LCD module. The LCD module then displays characters according to the 4-bit parallel display data by applying the LCD drive voltage. See Fig. 2.18 for a block diagram of the LCD controller on the CPU PCB.

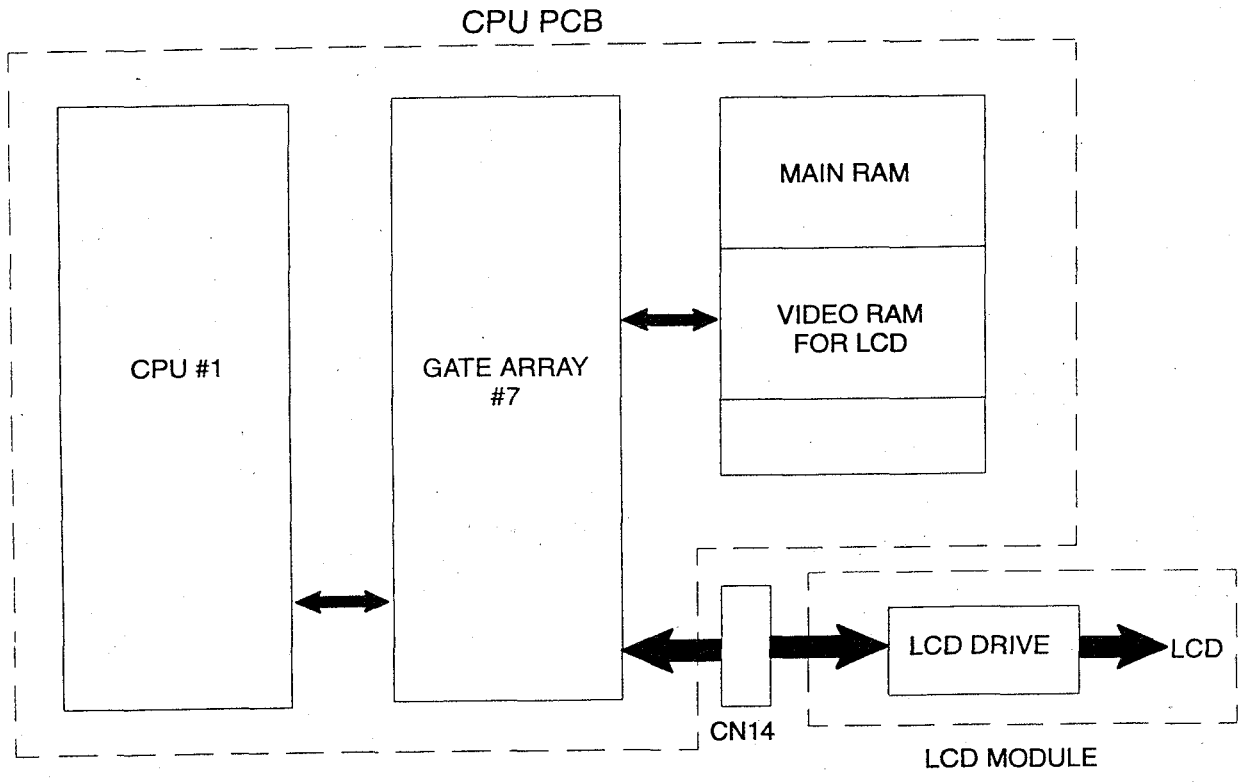

Fig. 2.18 – LCD Control Configuration (Block Diagram)

6.1 LCD Control

The LCD control circuit includes the LCD video gate array, video memory, and the LCD drive circuitry.

6.1.1 Video Gate Array (#7)

The video gate array (#7) is the core of the LCD control. It controls LCD and VRAM access. It writes display data to the video RAM area of PSRAM (#6). After reading the display data from the VRAM area of PSRAM (#6), it converts the data into 4-bit parallel data to display the data on the LCD module. The video gate array then outputs the converted data to the LCD module with the display timing control signal.

The video gate array (#7) also generates the control signals to be used for read and write processing of the upper Main RAM data by the CPU.

6.1.2 Character Configuration

Characters are configured in 6 × 9 dot area as shown in Fig. 2.19.

NOTE: Only a 5 × 7 dot area is used to display a single character; the remaining area is used for the space between characters.

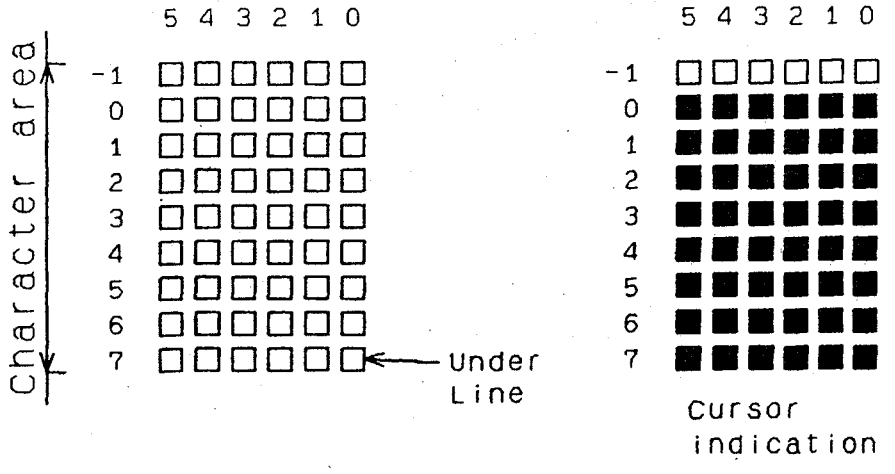

Fig. 2.19 – Character Configuration

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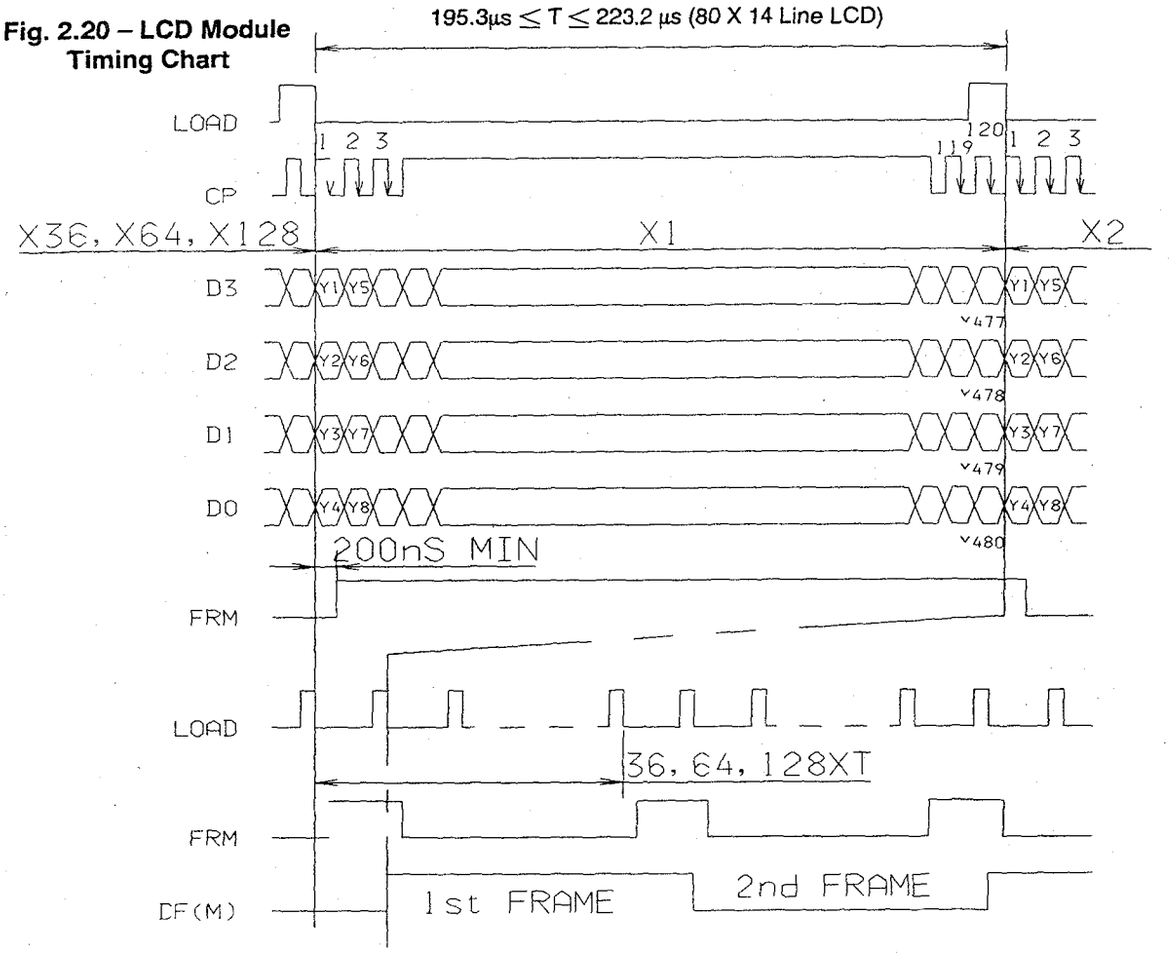
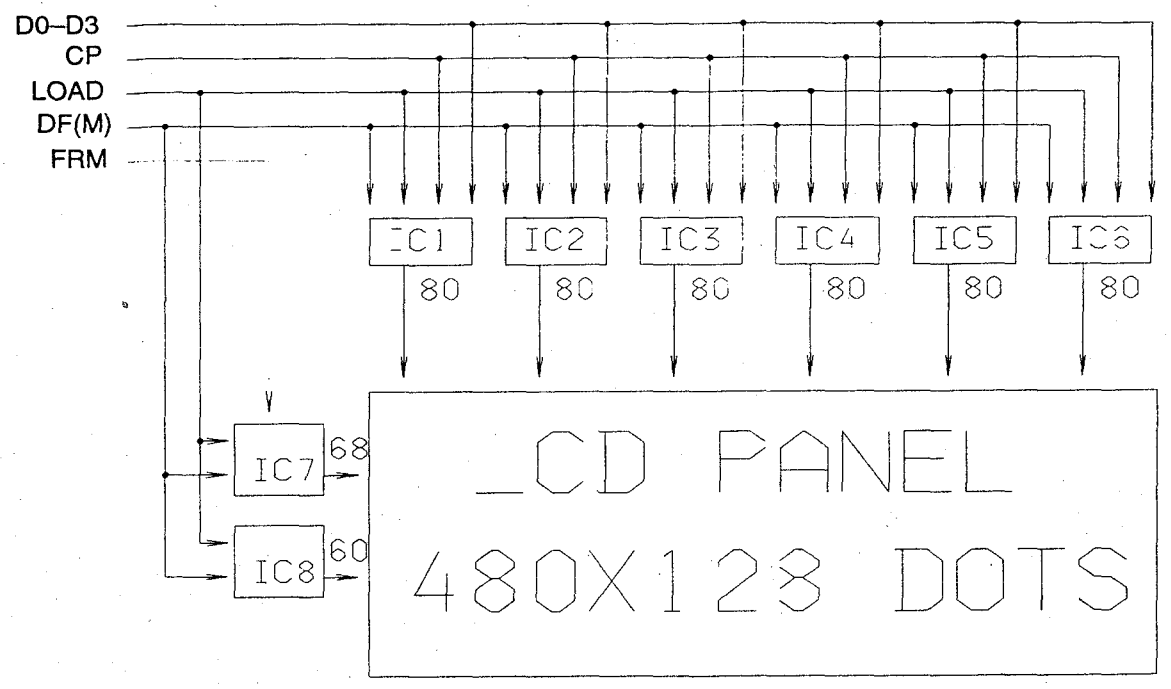
6.2 LCD Module Operation

An 80 column x 14 line LCD module is made up of 480 x 128 dots as shown in Fig. 2.21 (Block Diagram). The interface signals are shown in Table 2.7. Signals are sent to the LCD module in units of 4-bit dot data DO to D3). The display data for each raster is configured by 120 unit data transmissions. See Fig. 2.22. After the data for one raster is set, drive voltage is applied to that raster to give a display. Each display screen is constructed by 128 rasters on an 80 column x 14 line LCD module.

The FRM signal controls one screen display cycle, the LOAD signal controls one laster cycle, and the CP signal controls the 4-bit data transmission cycle. LCD operation timing is listed in the chart in Fig. 2.20. Usually, the LCD will deteriorate if DC voltage is applied. Therefore, AC voltage is applied to drive the LCD. The DF(M) signal controls this drive.

Fig. 2.20 – LCD Module Timing Chart





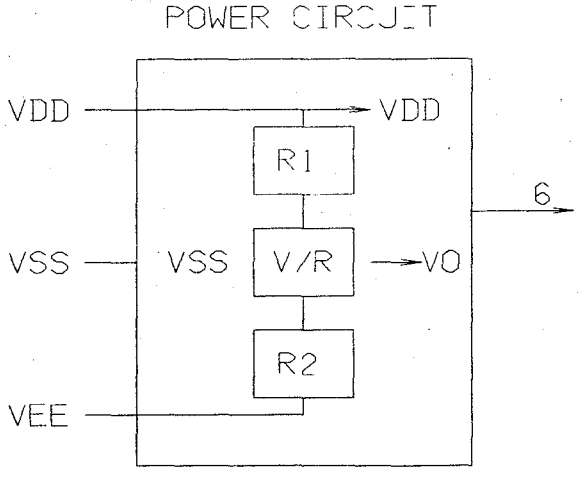


Fig. 2.21 – Block Diagram of LCD Module

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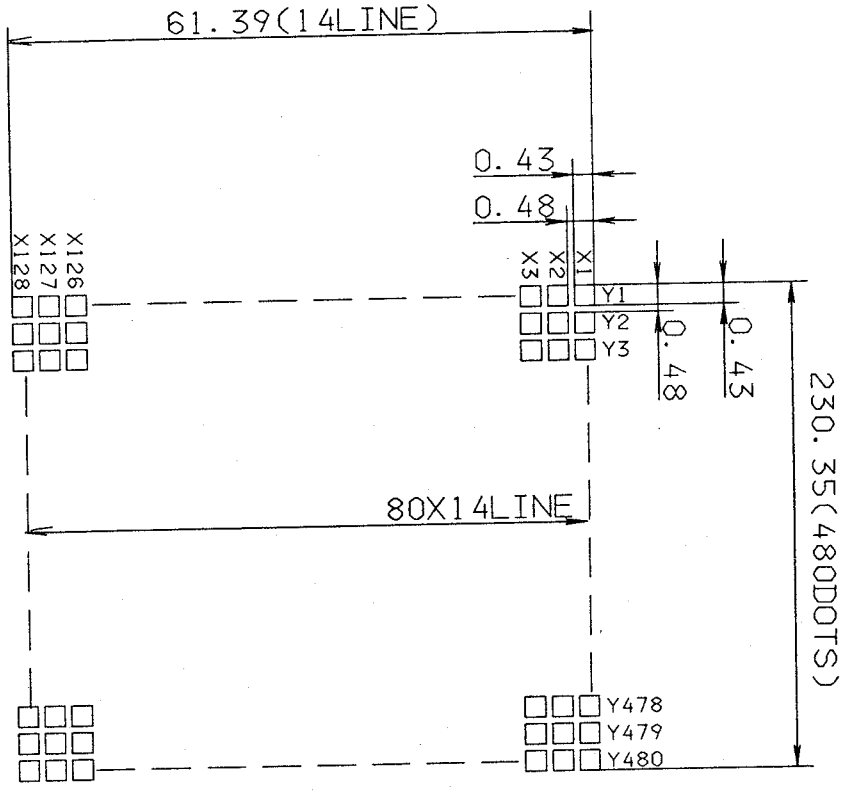
Fig. 2.22 – Display Pattern



PIN NO.	SYMBOL	LEVEL	FUNCTION
1	VSS	0V	Signal Ground (GND)
2	DF(M)	H/L	Alternate Signal for LCD Driving Waveform
3	FRM	H	Indicates the Beginning of Each Frame
4	LOAD	H→L	Data Latch Pulse
5	CP	H→L	Data Shift Pulse
6	D3	H/L	Display Data
7	D2	H/L	Display Data
8	D1	H/L	Display Data
9	D0	H/L	Display Data
10	VDD	+5V	Power Supply for Logic
11	VEE	–21.5V	Power Supply for LCD Driving
12	FG	GND	Frame Ground

Table 2.7 – LCD Interface Signal

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6.3 LCD Drive Voltage (VEE) Generation Circuit

The LCD drive voltage (VEE) is supplied by the circuit shown in Fig. 2.23. It consists of a DC-DC converter. The +24 VDC source voltage is switched continuously by the 20kHz pulses from gate array #7 to energize L1. The reverse voltage generated by L1 is rectified by D11 and regulated by ZD1. Zener diode ZD1 (RLZ20D) determines the VEE voltage (–21.5).

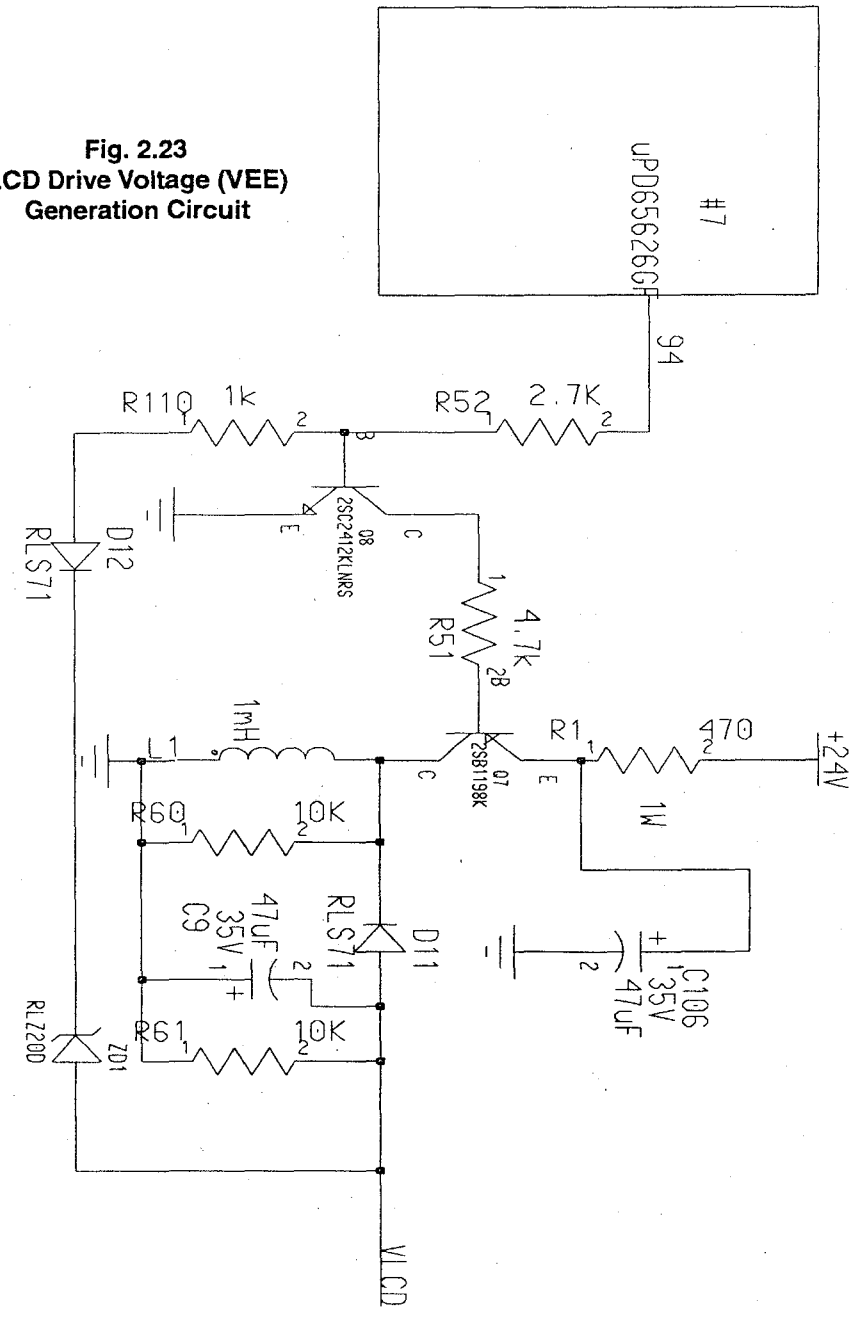

Fig. 2.23
LCD Drive Voltage (VEE) Generation Circuit

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7. FDD (Floppy Disk Drive) Control

7.1 FDD Configuration

The FDD consists of two sections: the FDD controller and the FDD module. The FDD controller circuit controls the contents to be received and stores the data in the FDD module. The FDD module drives the motors, sensors, and magnetic head. The interface signals between the FDD and the FDC are shown in Table 2.8 below:

Signals			Pin No.	Function
Read/Write Circuits	DRIVE SELECT Ø		10 12	This signal is set to LOW when the FDD unit is opening (except for the DD Motor).
	WRITE GATE		24	When this signal is set to LOW, data can be written by the WRITE DATA signal. When this signal is set to HIGH, the READ and STEP operations are enabled.
	WRITE DATA		22	Data is written at the falling edge of this signal while the WRITE GATE signal is LOW.
	READ DATA		30	This signal indicates the polarity data read by the head.
	SIDE 1 SELECT		32	This signal is used to select the head: LOW:Head 1 HIGH:Head 0
Motor Drive Circuit	DC MOTOR	MOTOR ON	16	This signal becomes LOW, starting the DD motor, when a disk is set in the drive. Setting this signal to HIGH or removing the disk stops the DD Motor.
	STEP MOTOR	STEP	20	This signal sets the head in the direction designated by the DIRECTION signal.
		DIRECTION SELECT	18	This signal designates the movement of the read/write head: LOW: Inward to the disk's center HIGH: Outward from the disk's center.
Status Check	WRITE PROTECT		28	When this signal is LOW, either there is no disk in the drive or the disk in the drive is write-protected.
	INDEX		8	This signal indicates the beginning of a track by outputting one pulse in each rotation of the disk.
	TRACKØØ		26	When this signal is LOW, the head is located at track 00 (the outside track). Otherwise, the signal is HIGH.
	DISK CHANGE		34	When this signal is LOW, there is no disk in the drive..

Table 2.8 – FDC (#8) and FDD Module Links (Interface Signals)

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7.2 FDD Operation

7.2.1 Basic operation

CPU (#1) writes commands to FDC (#8), and the FDC (#8) controls the FDD in accordance with these commands and reads/writes data. See Fig. 2.24.

7.2.2 Interface between CPU (#1) and FDC (#8)

If CPU (#1) accesses an internal register other than the data register in FDC (#8), the normal read/write operation will be performed. If CPU (#1) transmits data to or receives data from FDC (#8), DMA communications will be performed using the DMA function of CPU (#1).

CPU (#1) resets FDC (#8), detects the density signal which indicates whether the floppy disk is a 2DD or 2HD, and outputs to FDC (#8).

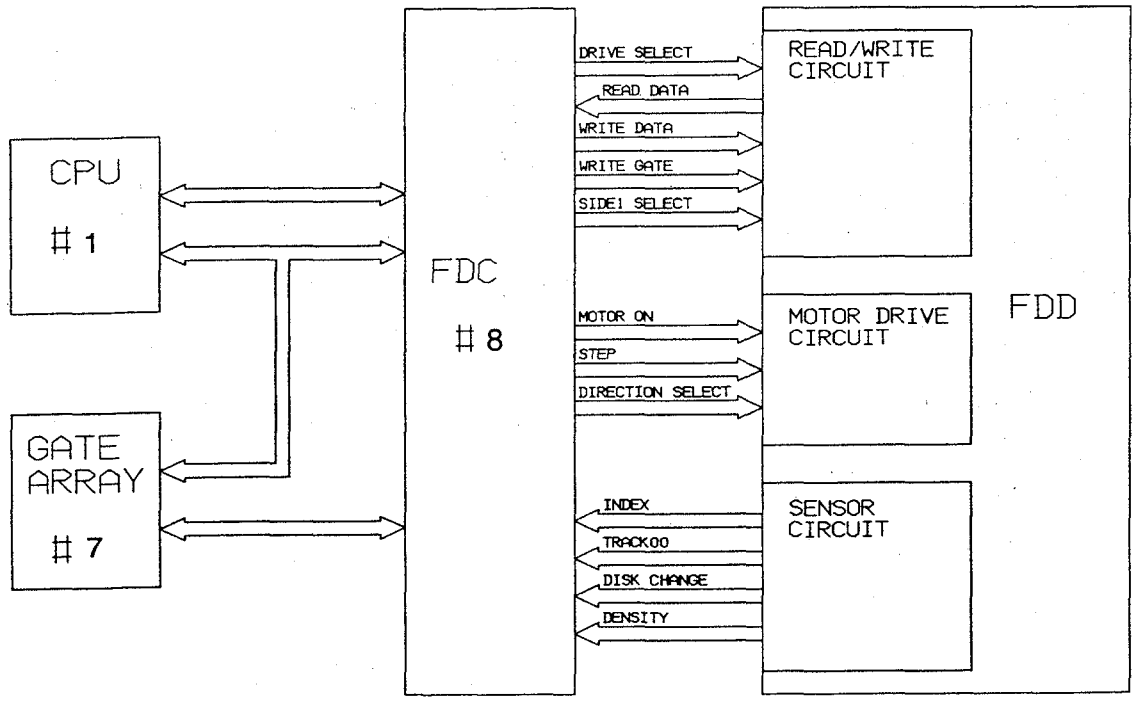

Fig. 2.24 – FDD Block Diagram

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7.3 FDD Module

The FDD Module is composed of the motor, sensor, magnetic head, and the IC that drives them. The FDD Module is controlled by the FDC #8 of the CPU PCB.

7.3.1 Read/Write Circuit

In read operation, the circuit amplifies the analog signals picked up by the magnetic head and converts the analog signal to serial digital pulses. The serial pulses are then transmitted to the FDC #8 and decoded to parallel digital data. In write operation, the circuit controls the current at the magnetic head according to the serial digital pulses from the FDC #8.

7.3.2 Motor Drive Circuit

The motor drive circuit consists of two parts: a DC motor drive circuit and a stepping motor drive circuit. The DC motor drive circuit controls the DC motor, which rotates the spindle according to the MOTOR ON signal from the FDC. The stepping motor drive circuit controls the stepping motor, which operates the magnetic head unit according to the "STEP" and "DIRECTION SELECT" signals from the FDC #8.

7.3.3 Sensor Circuits

The following sensor circuits detect the status of the FDD:

1. Write Protect Sensor

   When a write-protect notch on a disk is set to the write-protect position, the "WRITE PROTECT" signal becomes LOW. A micro-switch is used for detection.

2. Index Sensor

   The "INDEX" signal shows the beginning of a track; when the beginning of a track is detected, the "INDEX" signal becomes LOW. A magnetic sensor is used for detection.

3. Track 00 Sensor

   When the magnetic head is positioned in track 0 on a disk, the "TRACK 00" signal becomes LOW. A photo sensor is used for detection.

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4. Disk-in Sensor

When a disk is inserted in the FDD, this sensor outputs a LOW level signal (HIGH when no disk). The output of the sensor is connected to the controller and sent as a "DISK CHANGE" signal that shows whether a disk is changed; when a disk is changed, the "DISK CHANGE" signal becomes LOW. Once the "DISK CHANGE" signal becomes LOW, it remains low until the "STEP" signal is received from the FDC #8. A micro-switch is used for detection.

7.4 FDD Performance Specifications

Specifications			1 MB	2 MB
Capacity (MFM)	Not Formatted	Track (Kbyte)	6.25	12.50
		Disk (Kbyte)	1,000	2,000
	Formatted	Sector [sector] (Kbyte)	0.256 (16)	0.256 (32)
			0.512 (9)	0.512 (18)
			1.024 (5)	1.024 (10)
		Track [sector] (Kbyte)	4.096 (16)	8.192 (32)
			4.608 (9)	9.216 (18)
			5.120 (5)	10.240 (10)
		Disk [sector] (Kbyte).4	656.360 (16)	1310.72 (32)
			737.280 (9)	1474.56 (18)
			819.200 (5)	1638.40 (10)
Recording Density	Recording density of inside track (bpi) (side 1)		8,717	17,434
	Date transmission speed (Kbit/sec)		250	500
	Number of heads		2	
	Number of tracks		160	
	Track density (tpi)		135	
Recording Method			FM / MFM	
Motor Properties	Disk revolutions (RPM)		300	
	LSV (long–term speed variation) (%)		± 1.0 (max.)	
	ISV (instant speed variation) (%)		± 1.5 (max.)	
	Drive motor starting time (msec)		400 (max.)	
	Access time between tracks (msec)		3 (max.)	
	Settling time (msec)		15 (max.)	
Inserting and Ejecting the Disk		Insert (g)	400 (max.)	
		Eject (g)	1,000 (max.)	
Noise (scale A) (dB) (at a step rate of 3 ms)			40 (max.) (1 m away from FDD)	

Table 2.9 – FDD Performance Specifications

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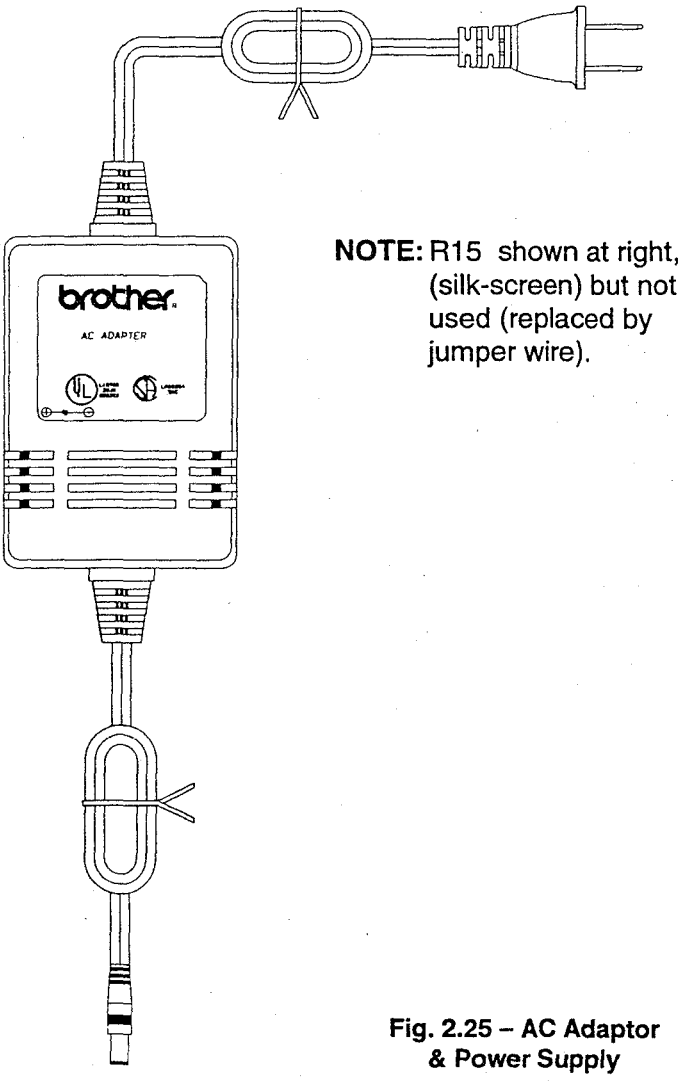
8. Power Supply PCB

8.1 Configuration

The AC input power is applied to the primary side of adaptor. The adaptor secondary output is converted to approx. +12 VDC by the internal bridge rectifier and capacitor. The +12 VDC is supplied to the power supply unit (PSU) through switch SW1 and fuse F1. The voltage is filtered through L1, and converted into +5V, +8V (backlight models only), and +24V. This voltage is then supplied to the main PCB through CN1.



NOTE: R15 shown at right, (silk-screen) but not used (replaced by jumper wire).

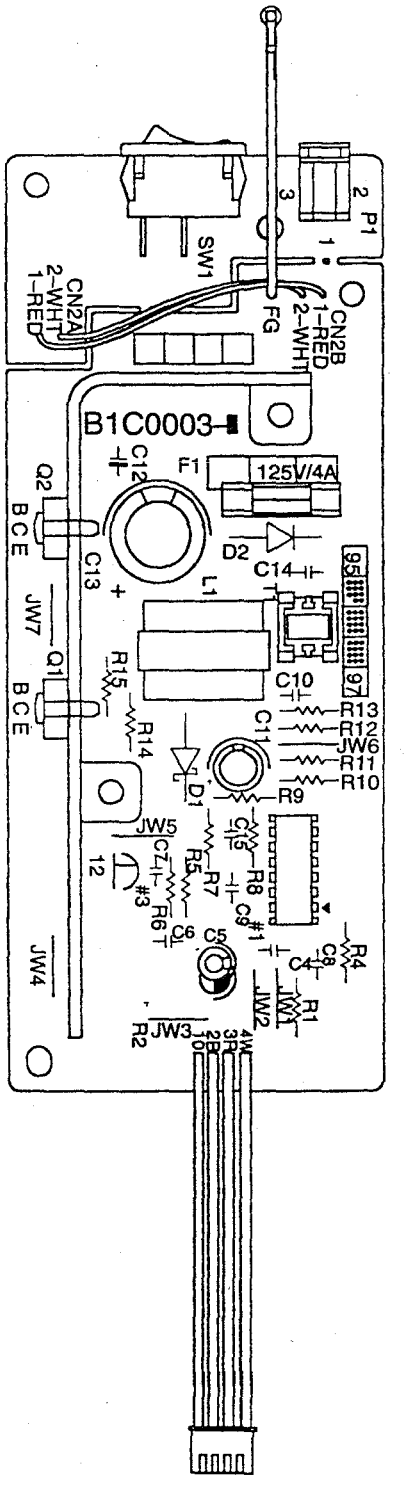
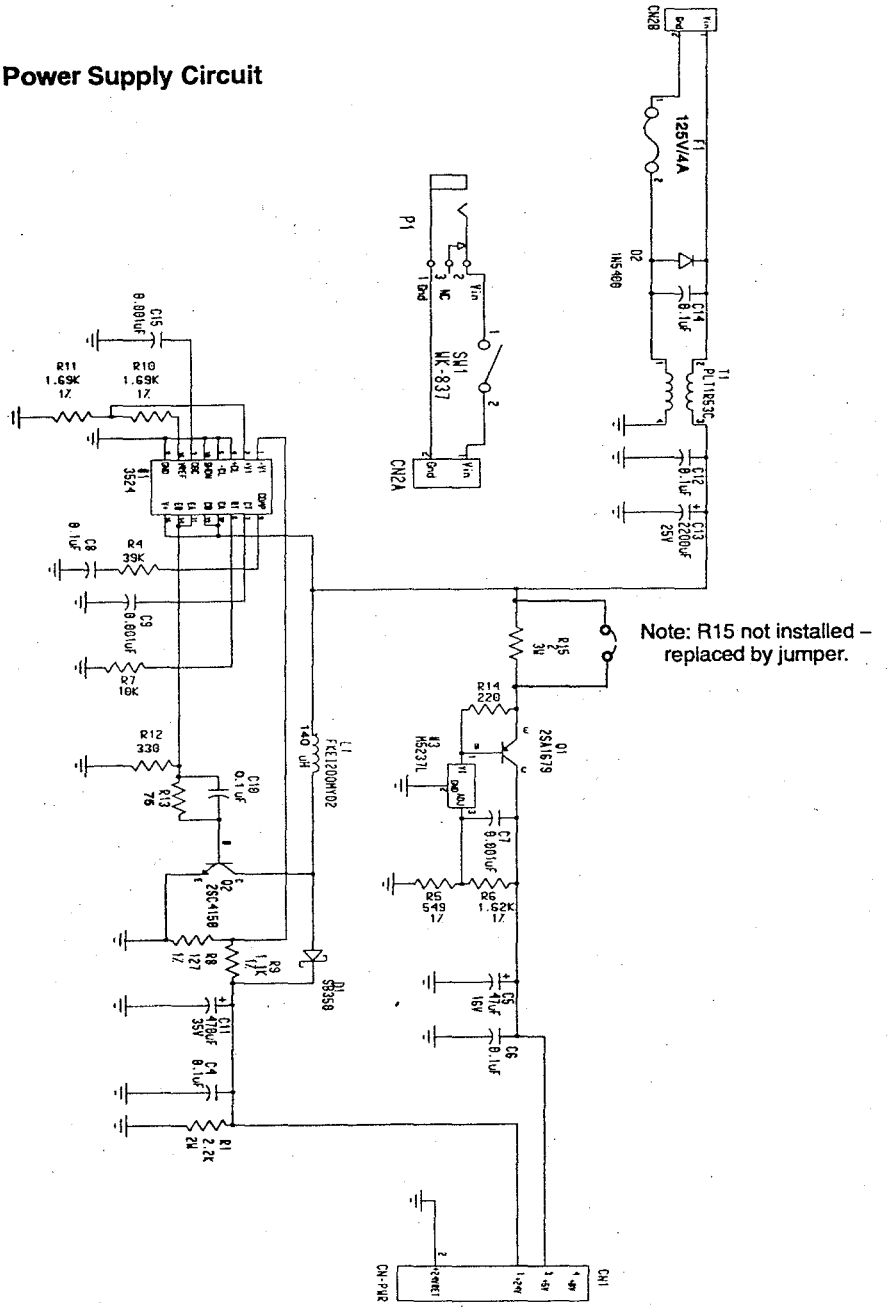


Fig. 2.25 – AC Adaptor & Power Supply

8.2 Circuit

The input voltage is converted to +5V by the regulation network Q1 and #3. The output voltage of Q1 is selected by R5 and R6. The +24V is obtained using the network #1, L1, D1, and Q2; the Q2 output voltage is determined by R8 and R9.See Fig. 2.26.

Fig. 2.26 – Power Supply Circuit



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PART II REPAIR

CHAPTER 3 TROUBLESHOOTING

1. INTRODUCTION

This chapter explains troubleshooting procedures for the word processor. Since it is impossible to troubleshoot all instances of a problem, only a limited number of cases are presented. Thorough understanding of the procedures given in each section is essential for efficient troubleshooting, and can provide a good insight to the problem.

2. PRECAUTIONS

2.1 Personal Safety

WARNING: If there is chance of electrical shock, this symbol will precede any instructions in this manual. Follow the safety advice carefully!

In addition to any specific warnings as described above, be sure to take the following precautions for your personal safety:

- Unplug the AC adaptor from the AC outlet before removing the covers and PCBs, or before making any mechanical adjustments.
- Unplug the AC adaptor from the AC outlet before checking continuity.
- When disconnecting a connector, grasp it firmly. Do not pull on the connector's lead wires. If the connector has a lock mechanism, unlock it before trying to disconnect it.

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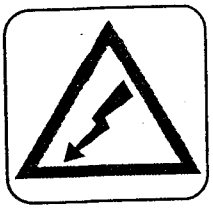
2.2 Handling ESD–Sensitive Parts

Many electronic products use parts that are known to be sensitive to electrostatic discharge (ESD). To prevent damage to ESD-sensitive parts, observe the caution symbols throughout these instructions, as well as the additional precautions below.

CAUTION: Electro-Static Discharge Hazard
Wear an anti-static wrist strap with ground wire to prevent damage to sensitive electronic components.



In addition to the usual precautions, such as turning off power before removing circuit boards:

- Keep the ESD-sensitive part in its original shipping container (a special "ESD bag") until you are ready to install it.
- Do not place the ESD-sensitive part on the machine cover or on a metal table; if you need to put down the ESD-sensitive part for any reason, first put it into its special bag.
- When holding ESD-sensitive parts, limit your body movement to prevent an increase of static electricity from clothing fibers, carpets, and furniture.
- Hold the ESD-sensitive part by its edge connector shroud (cover); do not touch its pins. If you are removing a plugable module, use the correct tool.
- Be extra careful in working with ESD-sensitive parts when cold-weather heating is used, because low humidity increases static electricity.
- Prevent ESD-sensitive parts from being accidentally touched by other personnel. Install machine covers when you are not working on the machine, and do not put unprotected ESD-sensitive parts on a table.
- If possible, keep all ESD-sensitive replacement parts stored in a grounded metal cabinet (case) until ready for use.

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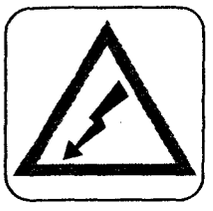
3. CHECKS *BEFORE* REPAIR

CAUTION: Electro-Static Discharge Hazard



Wear an anti-static wrist strap with ground wire to prevent damage to sensitive electronic components.

Check the following possible causes *before* attempting more extensive repairs to the machine:

- Run the appropriate Self Test operation (from the software) for the suspected problem *before* attempting any mechanical or electrical troubleshooting.
- Supply voltage: Check the AC input voltage and DC supply voltage for all sections. Make sure they meet specified voltage values.
- Connectors: Check all connectors and make sure they are tight.
- Fuses: Check for blown fuses (FI and the thermo-fuse inside the AC adaptor).

NOTE: In the logic control circuit, it is difficult to isolate faulty points in areas connected to the CPU by the address bus or the data bus or in the address bus or data bus connecting the VRAM to gate array #4. If a suspected problem involves the address bus or the data bus, first check the solder bridge and the cut circuit pattern. If a faulty point cannot be isolated, replace the peripheral devices or the PCB.

4. CHECKS *AFTER* REPAIR

After completing a repair, check to confirm that the trouble has been eliminated. Also, record the troubleshooting procedures used for reference.

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5. TROUBLESHOOTING FLOW CHARTS

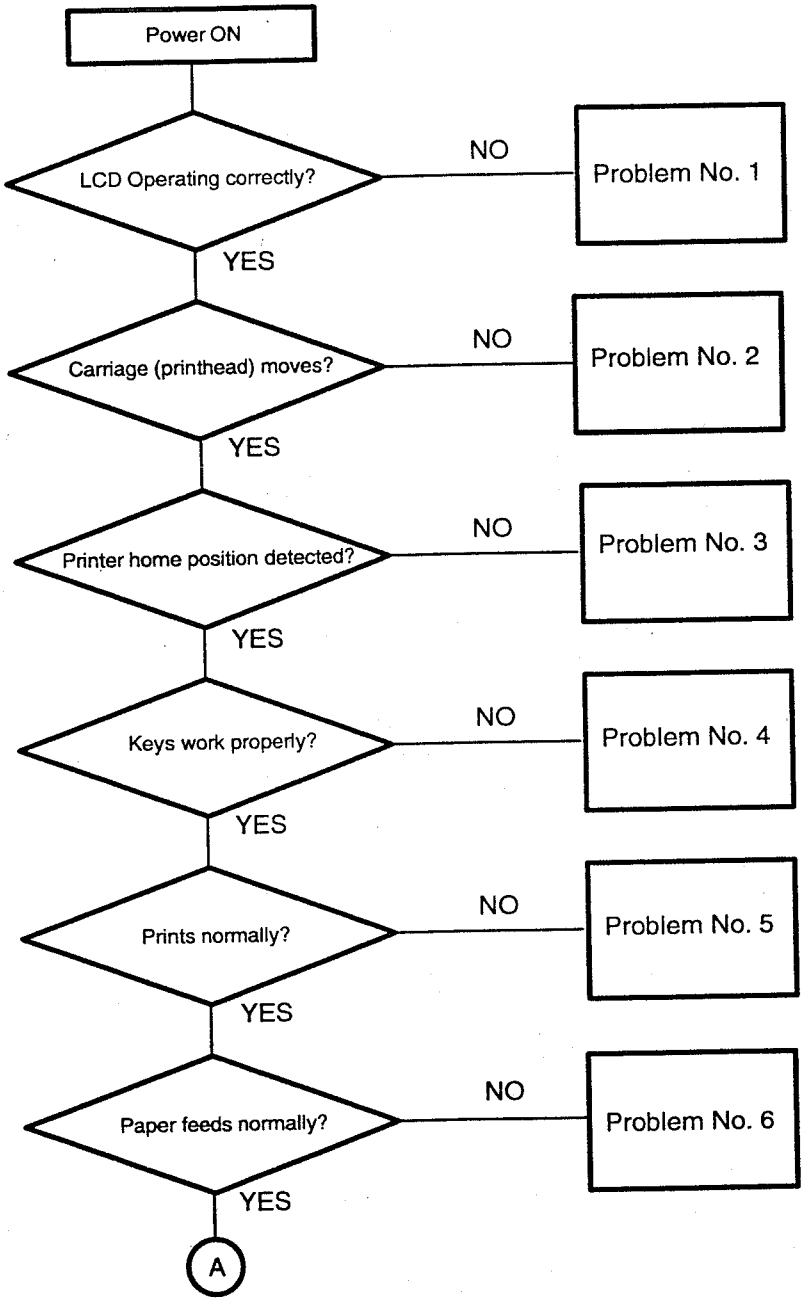

Fig. 3.1 – Troubleshooting Flowchart

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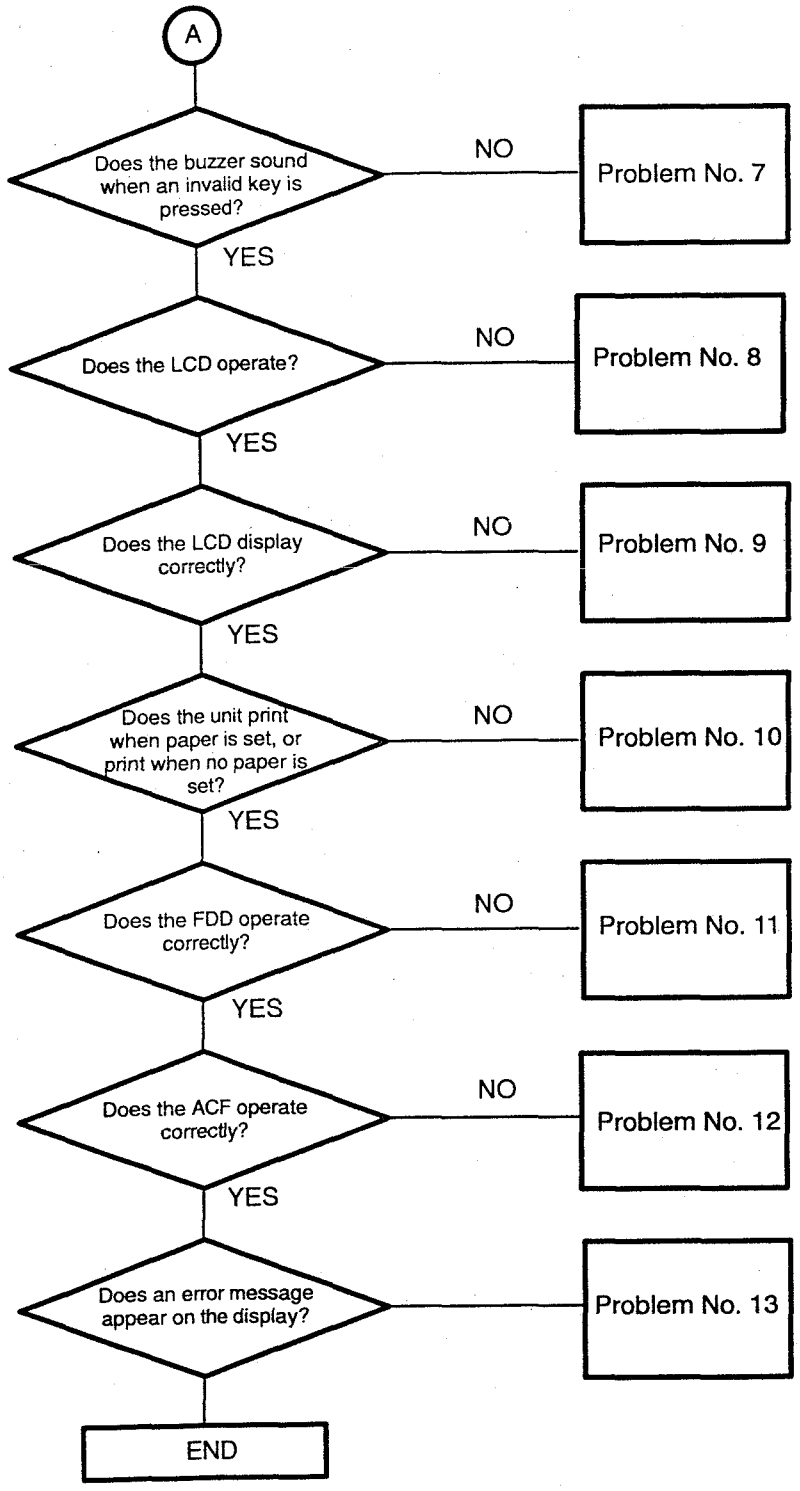

Fig. 3.2 – Troubleshooting Flowchart (cont'd.)

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6. FAILURE ANALYSIS

The following table lists the failure problems for troubleshooting all basic systems. See the *Troubleshooting Tables* on the following pages for a troubleshooting protocol.

No.	Problem
1	Nothing happens when the power is switched on (Nothing appears on the LCD).
2	When the power is switched on, the LCD display operates but the carrier does not return to its home position.
3	When the power is switched on, the carrier moves to the left but cannot detect its home position (i.e., the home position indexing mechanism is faulty).
4	Keys malfunction (do not insert characters or insert wrong characters)
5	Printing results abnormal (various unsatisfactory printing results)
6	Line Feed motor does not work properly.
7	The buzzer does not sound.
8	Power in on, but nothing appears on the LCD.
9	LCD displays operates, but data displayed is incorrect (does not match input).
10	Word Processor prints when no paper is set, or will not print when paper is set (Paper End Sensor malfunction).
11	The FDD does not operate correctly.
12	The ACF (Auto Cut-Sheet Feeder) does not operate.
13	An error message appears on the display.

Table 3.1 – Failure Analysis

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TROUBLESHOOTING TABLES

	Problem	Points to Check	Probable Cause	Corrective Action	Repair
1	Nothing happens when the power is switched on (Nothing appears on the LCD)	Is (at least) +11V present on the output plug of the AC adaptor?	Blown fuse	Replace the fuse	
		Is fuse F1 on the PS (power supply) PCB OK?	Blown fuse	Replace the fuse	
		Are harnesses CN1, CN2A, and CN2B on the PS PCB properly connected?	Harnesses improperly connected	Replace the power supply PCB	Rework the connectors
		Is T1 mounted flush to the PS PCB?	T1 improperly installed	Replace the PS PCB	Reinstall T1
		Is +5V present at CN1, pin 3 on the PS PCB?	Defective Q1	Replace the power supply PCB	Replace Q1
		Is +24V present at CN1, pin 1 on the PS PCB?	Defective Q2, Coil L1, or D1	Replace the power supply PCB	Replace Q2, L1, or D1
2	When the power is switched on (the LCD display operates but the carriage does not move)	With the power cable disconnected from the Main PCB at CN2, is +24V present at CN1, pin 1 on the PS PCB?	Defective Q2, Coil L1, or D1	Replace the power supply PCB	Replace Q2, L1, or D1
		With the motor cable disconnected, is the output voltage at Pins 5 & 6 of CN17 correct?	Defective Main PCB (or cable to Main PCB)	Replace the Main PCB (or cable)	
		Is resistance value across each of the phases and the COM terminal of the carriage motor correct? (about 30Ω) (–from common attached at pins 5&6 of CN17 to all four windings)	Broken wire in the carriage motor assembly (broken wire in the carriage motor) (defective connector)	Replace carriage motor assembly	
		Are Pins 11 & 14 of #1 switching on/Off?	Defective #1	Replace the PS PCB	
		Are carriage motor drive pulses output from pins 1–4 of CN17 just after power is switched ON? (Use an oscilloscope)	Defective #13B (Q1–Q4 might be defective, also D1–D3 or D8 might be defective)	Replace the Main PCB	Replace #13B, Q1–Q4, or D1–D3, D8
		Is the comparator circuit #15 operating correctly?	Defective #15	Replace the Main PCB	Replace #15
		Does the carriage motor occasionally stall?	Incorrect motor phase at home position (start up)	Adjust motor phase at home position (see Chapter 4, *INK JET PRINTER ASSEMBLY*)	
3	When the power is switched on, the carriage moves to the left but cannot detect its home position	Is the carriage index (home position) sensor open?	CA index sensor is not adjusted correctly	Readjust	
		Is the carriage index sensor connector connected to CN18 correctly?	Incorrect connection	Connect correctly	
		Does the signal level at pin 1 of CN18 remain HIGH when the carriage index sensor is closed?	Broken wire in the carrier index sensor assembly	Replace the carrier index sensor assembly (after confirming discontinuity)	

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	Problem	Points to Check	Probable Cause	Corrective Action	Repair
4	Keys malfunction (some keys work, others do not work; or keys work sometimes, (intermittently); wrong characters displayed)	Is the key top and the key actuator correctly mounted?	Faulty keyboard assembly	Replace the keyboard	
		Is the keyboard FPC securely connected to the main PCB CN23?	Keyboard FPC not connected properly	Reconnect	
		When a bad key is pressed, does the matrix row in which the pressed key is connected go LOW in synchronization with the output timing of output drive IC9?	If YES, faulty Main PCB	Replace the Main PCB	
			If NO, faulty keyboard	Replace the keyboard	
		Is solder present at the correct Country Specification Change-Over Solder Point?	Incorrect or faulty solder point for specified country (language)	Verify and correct solder point	
5	Abnormal Printing • voids in characters • light print • prints off the page • prints satellites • carrier moves, but does not print • printhead dries out prematurely • vertical alignment off • ink smearing • vertical streaks on paper • print lines crowded • gaps or overlapped areas in print	(1) Print Cartridge:			
		Is the ink cartridge good, and is it properly installed?	Cartridge empty, dried out, or not locked in and aligned with contacts in carriage	Replace with a new cartridge, and/or properly install the ink cartridge	Replace the ink cartridge and/or the printer flat cable (as req)
		After executing the purge (auto printhead cleaning) function from the keyboard (CODE+SHIFT+INK CHG),are there still printing problems?	Dirty or clogged ink jet nozzles	Replace the ink cartridge and run the Self-Print test, and/or replace the printer flat cable	
		(2) Printhead Carriage Assembly:			
		Is the flat cable firmly connected to the Main PCB?	Loose or worn printhead flat cable	Reconnect loose flat cable or replace it	Replace flat cable
		Is there wear or damage to the ink cartridge head locker, spring, or carriage assembly?	Head locker or spring worn or damaged; dirty, worn, or damaged gold-plated contacts on the printer flat cable	Remove the cartridge and clean the contacts on the flat cable in the carriage; Replace the carriage mechanism	Replace spring, head locker, or printer flat cable
		(3) Maintenance Station:			
		Is the wiper loose or worn?	Defective wiper	Replace wiper	
		Is the cap worn or loose?	Defective cap	Replace cap	
		Is the spring-loaded MS carrier moving freely?	Obstructions in carrier path; Spring broken or loose; MS carrier out of tracks	Remove obstructions, realign carrier on tracks, or replace MS assembly	Replace spring or MS assembly
		(4) Paper/Line Feed:			
		Are there any obstructions in the paper path?	Paper jam	Clear paper path	
		Is the correct type of paper in the machine?	Wrong paper (weight, size)	Try correct paper	
		Are star-wheels binding?	Star-wheels dirty, worn, or dislodged	Replace star-wheel assembly	
		Is the main roller assembly rotating properly?	Worn or broken gears, bearing, defective line feed motor?	Replace main roller assembly	Replace gears, bearing, and/or motor
		Does the line/paper feed motor rotate normally?	See Problem 6, Line Feed Motor		

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	Problem	Points to Check	Probable Cause	Corrective Action	Repair
6	The line feed (LF) motor does not rotate normally	Is the line feed motor turning when activated? –Is it noisy?	Defective line feed motor	Replace line feed motor	
		Are any motor harness wires damaged?	Defective motor wiring harness	Replace line feed motor	
		Are there binds in the line feed motor or gear train?	Worn, dirty, damaged, or obstructed gear train, improper gear backlash	Clean/remove obstructions replace damaged gear(s), space motor from gear	
		Is the line feed motor gear loose or worn?	Loose motor screws or worn LF motor gear	Tighten motor screws replace line feed motor	
		Is the resistance between the pin 6 of the line feed motor and each phase normal? (about 45Ω)	Defective line feed motor (broken motor wire or defective connector)	Replace the line feed motor assembly	
		Are line feed motor drive pulses output from PB0 to PB3 of printer gate array (#13B) when printing?	Defective printer gate array #13B	Replace the Main PCB	
		Is output at the output pin of transistor array #16 on and off according to the drive pulses indicated above?	Defective #16 or circuit on the Main PCB	Replace the Main PCB	Replace #16
7	Buzzer does not sound	Are pulses of 4kHz present on one pin and about. 5V present at the other pin of buzzer BZ1?	If YES, defective buzzer If NO, defective Main PCB	Replace the buzzer Replace the Main PCB	
8	Power is ON (motors move), but nothing appears on the LCD display	Is the contrast setting correct?	Faulty contrast adjustment	Re-adjust	
		Is the LCD harness free of breakage?	Broken harness	Replace the harness	
		Is the correct voltage (about –21.5V) applied to the LCD on pin 2 of connector CN14 of the Main PCB?	Incorrect power supply voltage to LCD module	Replace the Main PCB	
		Is oscillator XT2 operating correctly? (Use an oscilloscope to check)	Defective XT2		Replace XT2
9	LCD display is incorrect	Is solder present at the correct Country Specification Change-Over Solder Point?	Incorrect or faulty solder point for specified country (language)	Verify and correct solder point	
		Is there an output waveform at each pin in the connector CN14?	Defective #7 or solder bridge	Replace the Main PCB	Replace #7
		Is there faulty soldering in the LCD module?		Replace the LCD module	

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	Problem	Points to Check	Probable Cause	Corrective Action	Repair
10	WP prints when no paper is set, *or* will not print with paper set (Paper End Sensor malfunction)	Is the PE (paper end) sensor properly installed?	Incorrect installation	Reinstall	
		Is the paper end sensor lever stuck?	Incorrect installation	Reinstall	
		Is the paper end sensor misaligned?	Incorrect installation	Reinstall	
		Is the paper end sensor damaged?		Replace the PE sensor	
		Is (at least) +4V applied to pin 3 of CN16?	Defective Main PCB	Replace the Main PCB	
		Does Pin 1 of CN16 (CN-PE) go HIGH when paper is not set and LOW when paper is set?	Harness wire break	Replace the paper end sensor	Replace the harness
			Defective photo sensor		Replace the photo sensor
		Does the sensor function abnormally even though the above signals are normal?	Defective #13B	Replace the Main PCB	
11	Does the FDD operate correctly?	Is CN6 (power harness) properly connected?	Loose or improperly connected harness	Reconnect	
		Is the FDD ribbon cable correctly connected?	FDD ribbon cable is not correctly connected	Reconnect	Replace the FDD ribbon cable
		ERROR on performing the FDD test (Self-Test)	Defective FDD or FDD ribbon cable	Replace the FDD or the FDD ribbon cable, as req.	Replace the FDD or cable
			Defective FDC #8	Replace the Main PCB	Remove the Main PCB and replace the FDC #8
12	Auto Cut-Sheet Feeder (ACF) does not start or does not feed properly	Is the ACF installed properly?	Incorrect installation	Reinstall	
		Does the sheet lead edge contact the first print roller?	Paper jam, incorrect paper wt./type; worn main shaft rollers	Clear paper path, install proper wt./type paper	Replace main shaft rollers
		Are the drive gears working properly?	Worn, misaligned, or damaged gears	Replace the gear holder assembly and/or the main shaft gear	
13	Error Message appears on the display	(1) "Check printer! Press any key to continue." (after executing print command) • Is the paper path clear? • Is the CA index (home position) sensor working properly? • Is ROM/RAM working properly?	Possible paper jam Home position cannot be detected (defectiv index switch) Defective #2/#4 (ROM?RAM)	Check/clear paper path See Problem 3 *Home Position Sensor checks* Execute the Self–Print test (in SELF TEST) and verify that the ROM/RAM (sum-check) test is normal (if error on Self-Test, replace the main PCB)	If ROM/RAM error, replace the main PCB
		(2) "Incorrect spec!" (when powered on) • Do the soldering points for the Country Code Change-Over circuit match the ROM?	Solder point setting is wrong, or the ROM is incorrectly mounted	Replace the main PCB	Set the correct solder point, or replace the ROM
		(3) "RAM down!" (RAM cannot be accessed at power on) • Is the RAM installed correctly?	RAM improperly installed (e.g. solder bridge), or defective RAM	Replace the main PCB	Reinstall/replace the RAM

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7. Self-Tests

From the Main Menu, two self–test modes are available:

1. Self-Print

   Press the CODE + SHIFT + RETURN keys.

2. Self-Test

   Press the CODE + SHIFT + BACKSPACE keys.

7.1 SERIAL NUMBER Input Display

The machine prompts you for the unit serial number after the Self-Test mode is accessed, but *before* the test is started:

- From the SELF PRINT screen
- From the SELF TEST menu, after selecting a test, or after pressing the "S" key.

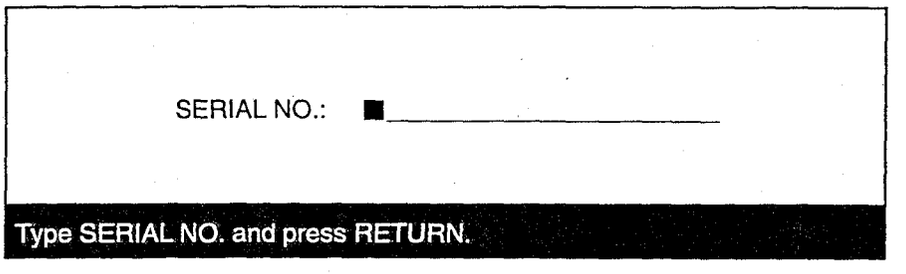

Fig. 3.3 – Serial Number Entry Display

NOTES: • The maximum number of characters that can be input is 9; alphanumeric keys are the only acceptable input.

- The RETURN key can also be pressed without entering a serial number.
- Pressing CANCEL while the SERIAL NUMBER prompt is displayed cancels any number entered (before pressing RETURN), and returns to the SELF TEST menu.

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7.2 Self Print Mode

(1) From the Main Menu, press CODE+SHIFT+RETURN. *The SELF PRINT display appears, with the SERIAL NO. input pop-up screen.*

(2) Enter the unit serial number and press RETURN (or press return without entering a number). *The SERIAL NO. pop-up is replaced by another pop-up window prompting you to verify whether the optional CUT SHEET FEEDER mechanism is installed (the default setting is "OFF" – no CSF installed).*

(3) Press RETURN (if no ACF installed), or press the SPACE bar to change the setting to "ON" (if ACF installed), and press RETURN. *The CSF pop-up window disappears, and a sum check of the MAIN RAM, MAIN ROM and DICTIONARY ROM are then performed.*

```
                    ***** SELF PRINT*****

VIDEO RAM           Checking...     OK.     NG.
MAIN ROM            Checking...     OK.     NG.
CG ROM              Checking...     OK.     NG.
DICTIONARY ROM      Checking...     OK.     NG.
D-RAM               Checking...     OK.     NG.
                                    (NORMAL)  (ABNORMAL)
```

Fig. 3.4 – Self-Print Screen

NOTES:
- "OK" is displayed if the checked item is normal ("NG" if there is an error). If the result of all checks is "OK", the carriage is returned and the self-print ("all character") test is started.
- If there are any errors in the sum check, self-printing will not start. The buzzer will not sound, but the SELF PRINT screen will remain. It will not be possible to proceed with any operation (cycle the power switch to reset the system).
- The following print format settings are in effect for the test:

Font type:	Brougham
Font size:	12 point
Type style	Normal
Line space:	Auto
Left/right margins:	0 – 9.1 inch (w/o CSF)
	1 – 7.4 inch (with CSF)
Tab setting:	None

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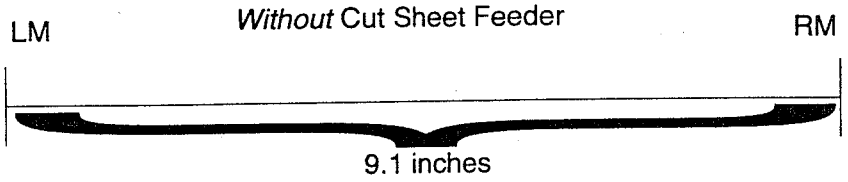
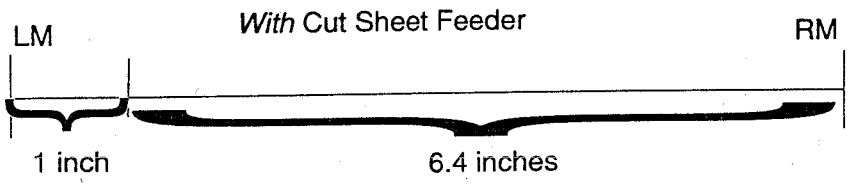
- The following printing pattern is printed:

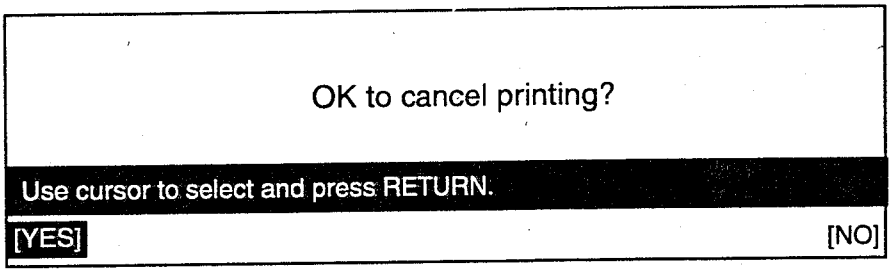


[Memory Codes 21(H) to 7E(H) printed]



[Memory Codes 21(H) to 7E(H) printed]

- Without the Cut Sheet Feeder, the serial number is printed on the first line (if it was input), and then 65 lines of characters are printed at 91 characters per line; with the Cut Sheet Feeder, the serial number is printed on the first line (if it was input), and then 59 lines of characters are printed at 91 characters per line; with each line beginning with one character from the right of the previous line.
- If the CANCEL is pressed while the serial number input screen is displayed, the input character string will not be registered as a serial number and display will return to the Main Menu screen.
- If the SPACE BAR or CANCEL key is pressed during printing, self-printing is suspended and the pop-up screen shown below is displayed:



  - ◆ If RETURN is entered while the cursor is located at "YES", self-printing is canceled and the display returns to the Main Menu.
  - ◆ If RETURN is pressed while the cursor is located at "NO", self-printing is resumed.

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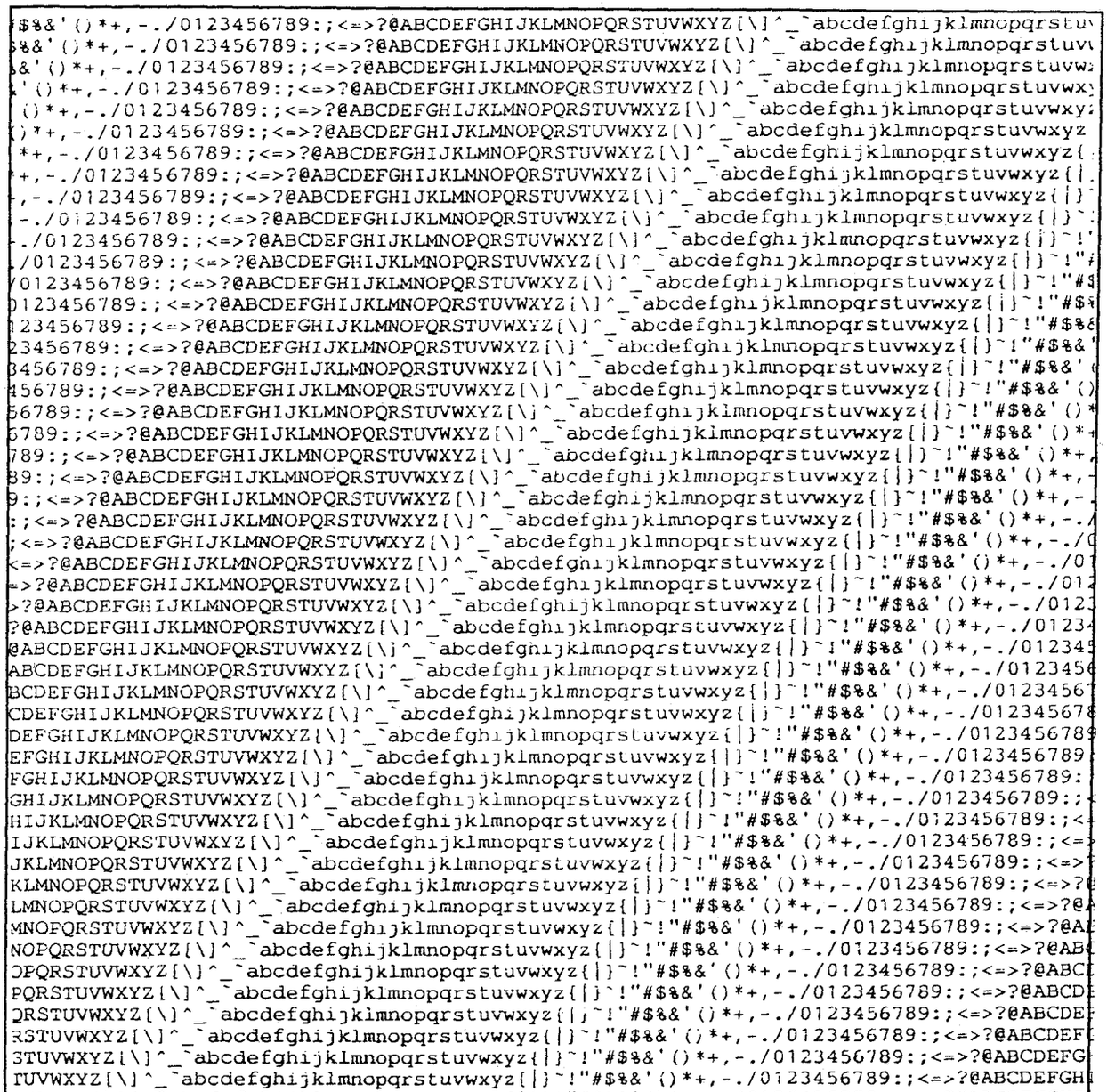

Fig. 3.5 – Results of Self-Print Test

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7.3 Self-Test Mode

There are 6 tests types available in Self-Test Mode: (1) LCD Display tests, (2) Printer Checks, (3) Keyboard Test, (4) FDD Tests , (5) PE (Paper Exist), and (6) CR (Carriage Reset to Home Position).

(1) From the Main Menu, press the CODE + SHIFT + BACKSPACE keys, and the menu shown below displays.

(2) Press the character key for the desired test.

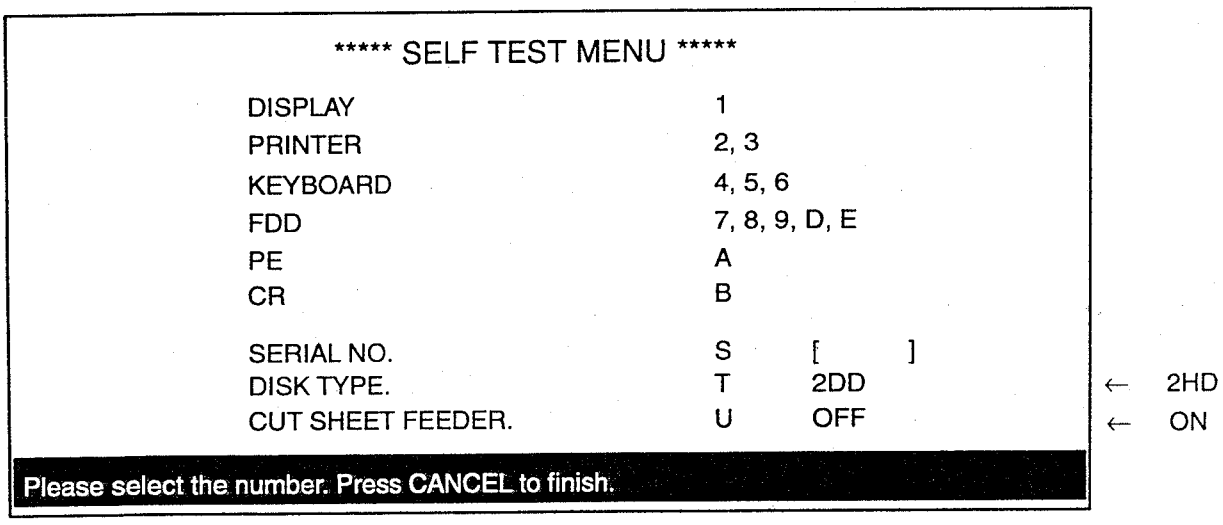
***** SELF TEST MENU *****
DISPLAY 1
PRINTER 2, 3
KEYBOARD 4, 5, 6
FDD 7, 8, 9, D, E
PE A
CR B
SERIAL NO. S [ ]
DISK TYPE. T 2DD ← 2HD
CUT SHEET FEEDER. U OFF ← ON
Please select the number. Press CANCEL to finish.

Fig. 3.6 – Self-Test Menu

NOTES:
- Pressing the CANCEL key while the above menu is displayed will return the display to the Main Menu.
- The keys that can be used while the Self Test menu is displayed are:

Alphanumeric keys	start the test
P INS, PUP/P DOWN	feed paper
CANCEL	returns to the Main Menu

- If a serial number has been input, it will be displayed in the brackets to the right of the serial number menu item; if no serial number has been entered, only the brackets will be displayed.
- If there is a problem with the printer, an error message is displayed, and testing will continue without performing the printer test.
- During printing, HELP is enabled. If HELP is accessed, printing is suspended; when HELP is closed, printing resumes.

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7.3.1 DISPLAY (LCD) Tests

There are four display checks available: 1) CHECK, 2) CROSS, 3) BLACK, and 4) DISP.Q.

(1) From the Self Test menu, select "1" to open the LCD Test Menu.

(2) Press the number key for the desired display test. *The screen displays the selected test pattern.*

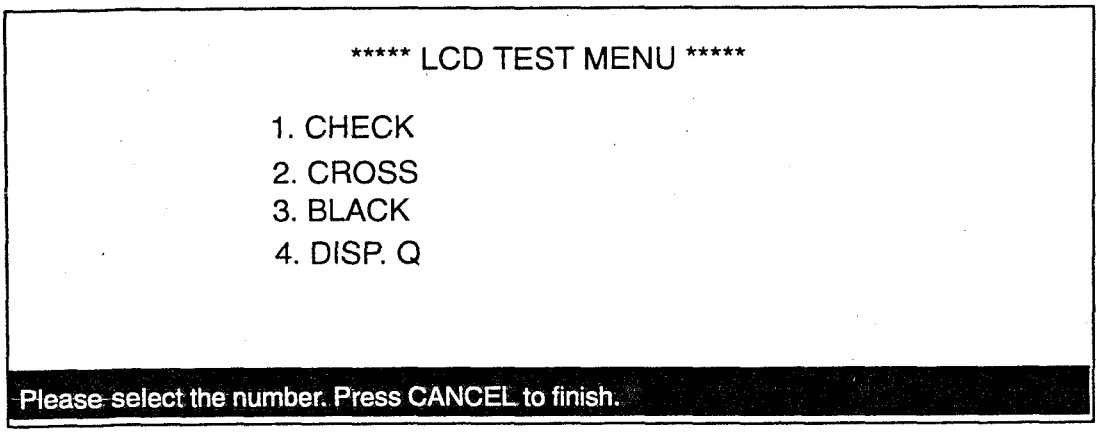

Fig. 3.7 – LCD Test Menu

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Check Test

The CHECK test displays every other bit as shown below (magnified).

Select "1" from the MENU screen.

NOTE: Press the space bar and the displayed bit pattern is reversed.

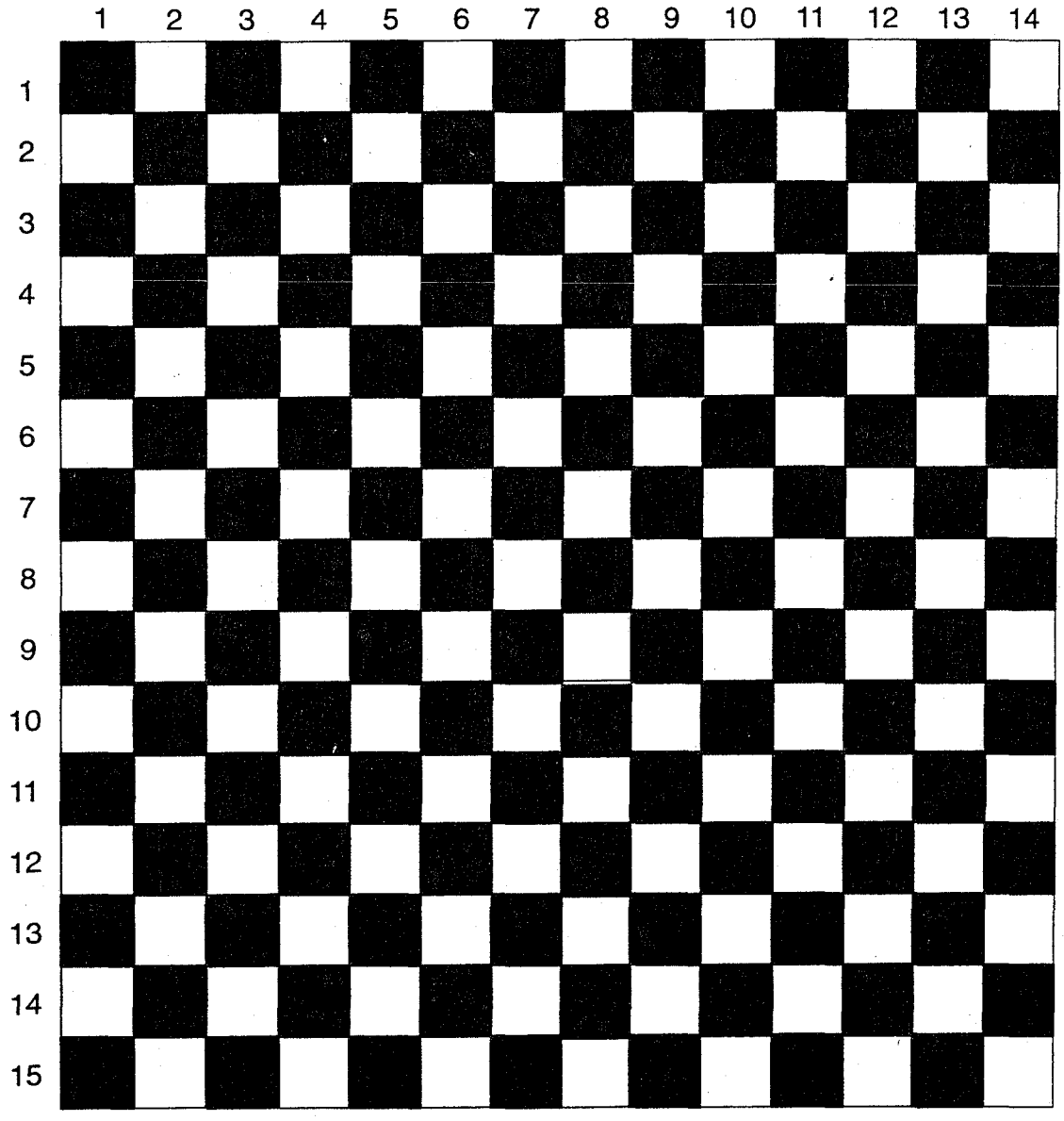

Fig. 3.8 – CHECK Test Display (magnified)

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Cross Test

The CROSS test displays the grid pattern shown below (magnified).

Select "2" from the MENU screen.

NOTE: Press the space bar and the displayed pattern is reversed.

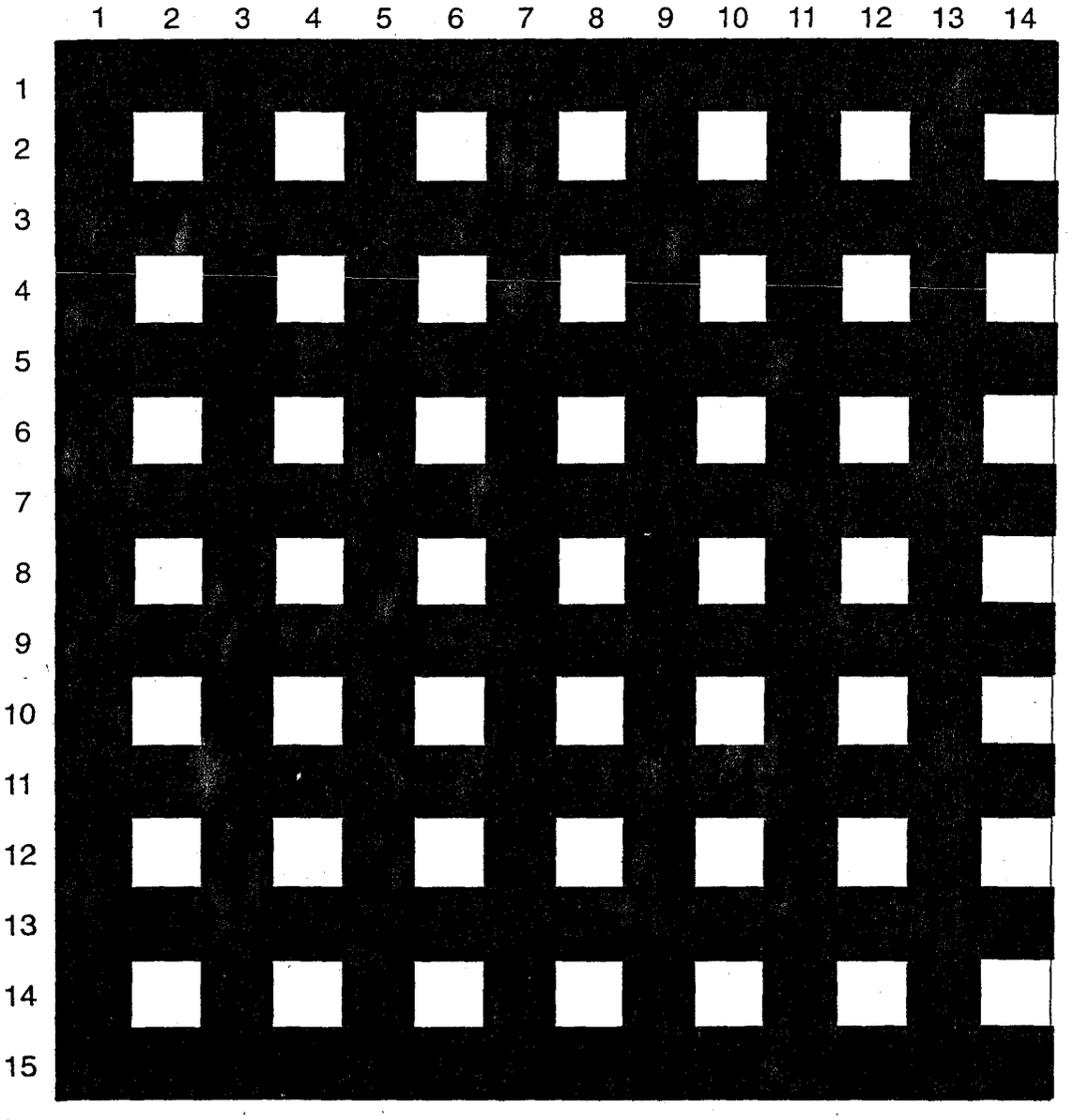

Fig. 3.9 – CROSS Test Display (magnified)

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Black Test

The BLACK test checks for missing dots (pixels).

Select "3" from the MENU screen.

NOTE: Press the space bar and the displayed pattern is reversed.

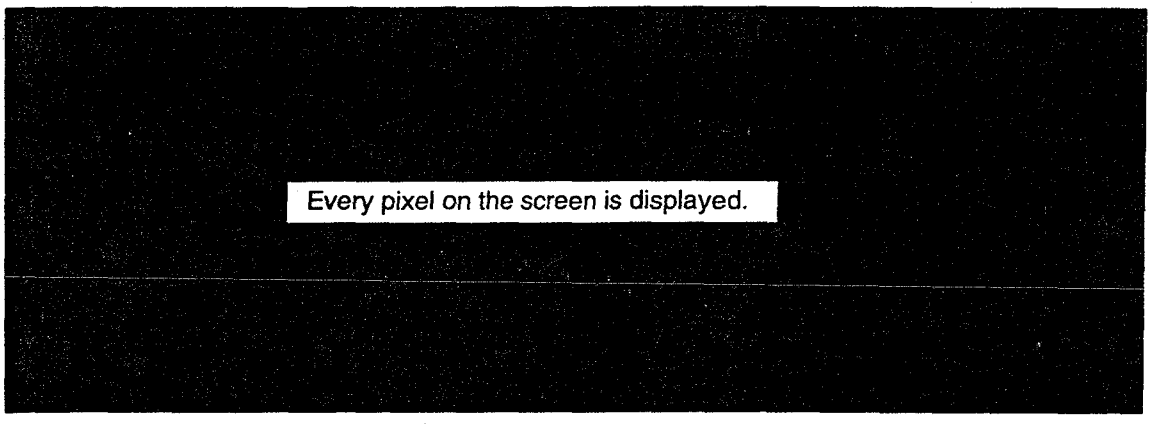

Fig. 3.10 – BLACK Test Display

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Display Q Test

The DISP Q test displays the character "Q" on the entire screen.

Select "4" from the MENU screen.

NOTE: Press the space bar and the displayed pattern is reversed.

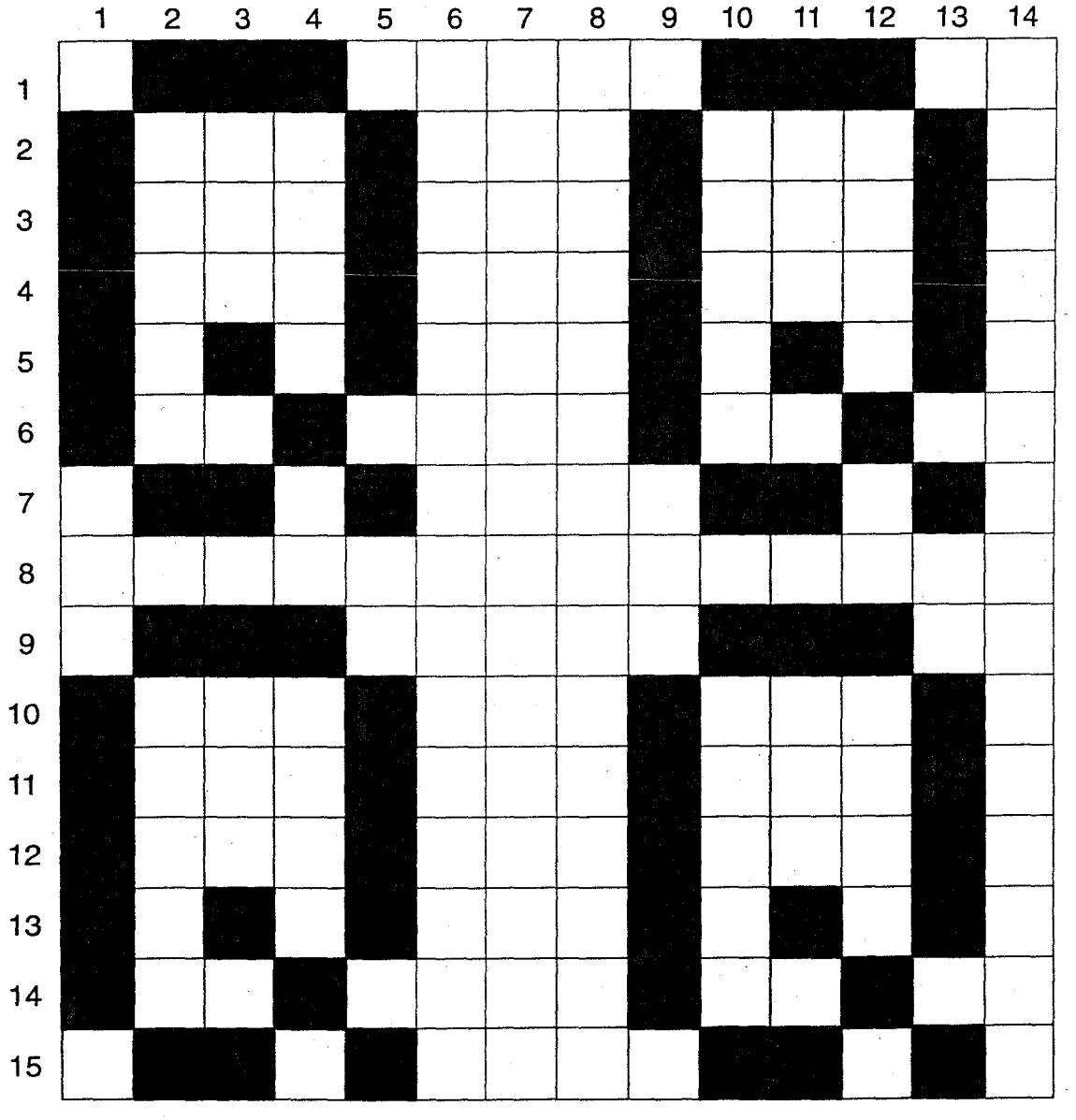

Fig. 3.11 – DISP. Q Test Display (magnified)

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7.3.2 Print Checks

There are 2 self-test print checks.

Print Test Pattern 1

Purpose: to check that all characters are printed correctly.

From the Self Test menu, select "2" from the MENU screen. *When printing is complete, the display automatically returns to the Self Test menu. The diagram (see in Fig. 3.13) shows which characters should be printed and their locations in reference to each other. A sample of the printed test pattern is shown in Fig. 3.14.*

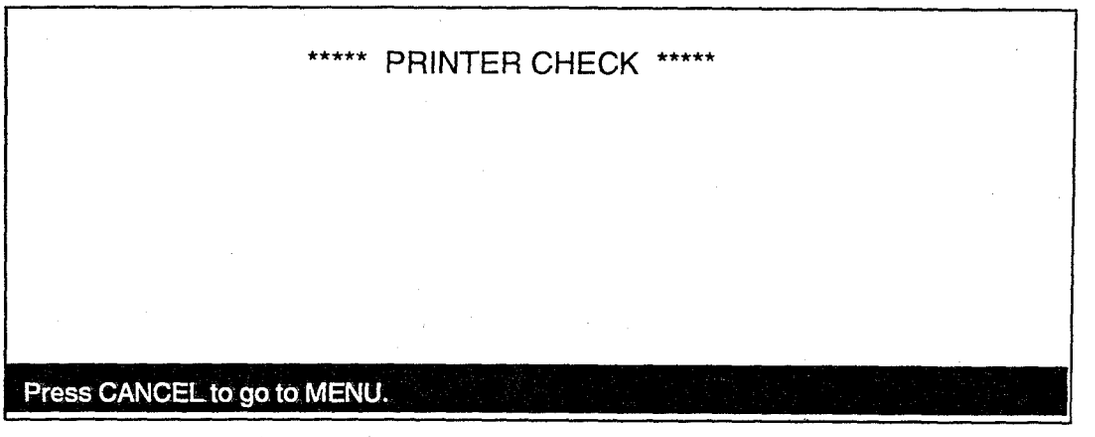

Fig. 3.12 – Printer Check #1 (in progress) Display

NOTES:
- A paper check is performed before printing. If paper is set, the print test is executed; if no paper is set, insert paper and press RETURN.
- Pressing the CANCEL key during printing will stop the test (paper is advanced), and return the display to the Self Test menu.
- If a serial number has been input before starting the test, the pop-up window will prompt for the serial number; either enter the serial number, or press RETURN to start the test. If a serial number is entered, it will be printed on the first line of the test.
- During printing, HELP is enabled. If HELP is accessed, printing is suspended; when HELP is closed, printing resumes.

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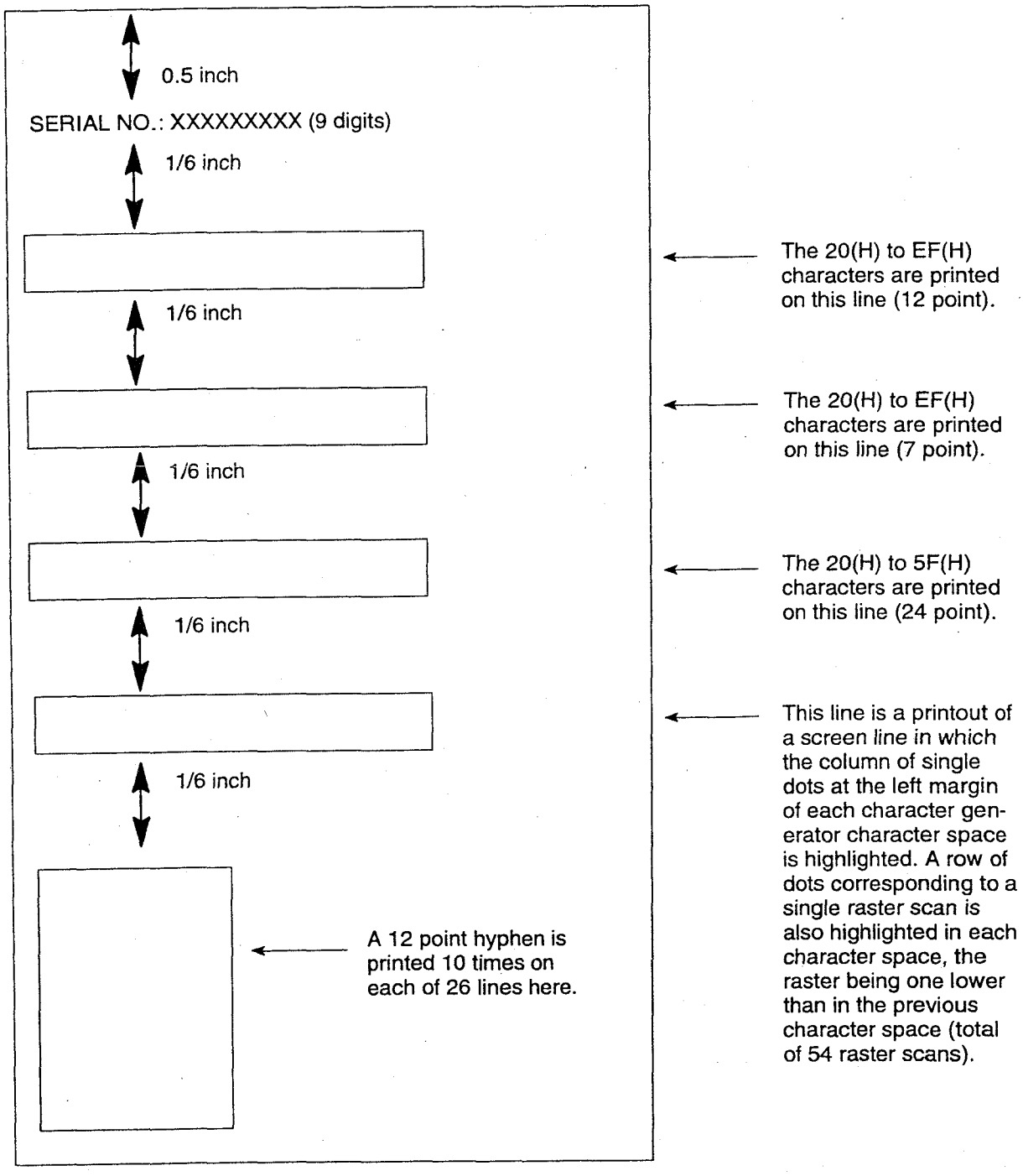
0.5 inch
SERIAL NO.: XXXXXXXXX (9 digits)
1/6 inch
1/6 inch
1/6 inch
1/6 inch
1/6 inch
A 12 point hyphen is printed 10 times on each of 26 lines here.
The 20(H) to EF(H) characters are printed on this line (12 point).
The 20(H) to EF(H) characters are printed on this line (7 point).
The 20(H) to 5F(H) characters are printed on this line (24 point).
This line is a printout of a screen line in which the column of single dots at the left margin of each character generator character space is highlighted. A row of dots corresponding to a single raster scan is also highlighted in each character space, the raster being one lower than in the previous character space (total of 54 raster scans).

Fig. 3.13 – Diagram of Print Test Pattern 1

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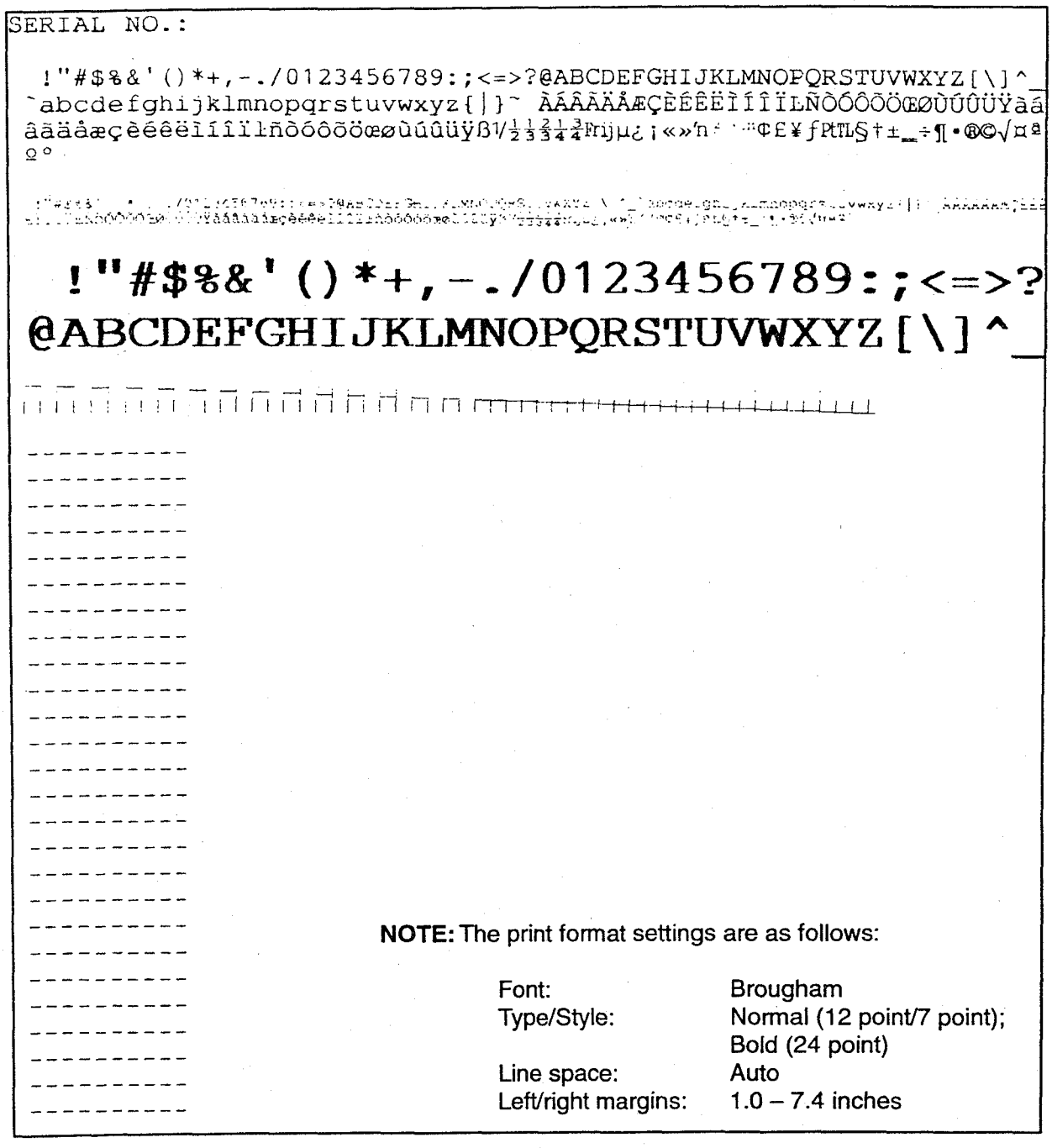

Fig. 3.14 – Sample Print Test Pattern 1

Print Test Pattern 2

This print test checks that all characters are printed correctly.

From the Self Test menu, select "3" from the MENU screen. *When printing is complete, the display automatically returns to the Self Test menu.* A sample of the printed test pattern is shown in Fig. 3.14.

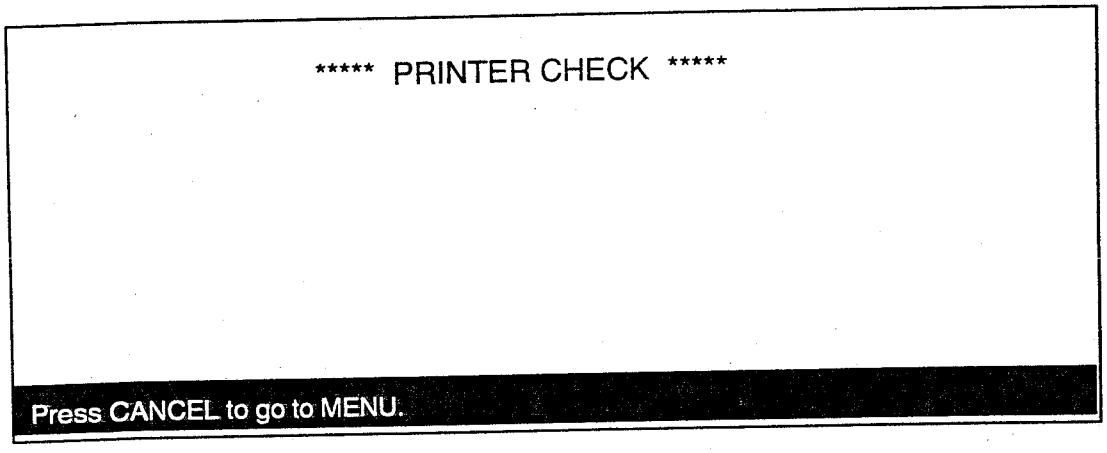

Fig. 3.15 – Printer Check #2 (in progress) Display

NOTES:
- A paper check is performed before printing. If paper is set, the print test is executed; if no paper is set, insert paper and press RETURN.
- Pressing the CANCEL key during printing will stop the test (paper is advanced), and return the display to the Self Test menu.
- If a serial number has been input before starting the test, the pop-up window will prompt for the serial number; either enter the serial number, or press RETURN to start the test. If a serial number is entered, it will be printed on the test.
- During printing, HELP is enabled. If HELP is accessed, printing is suspended; when HELP is closed, printing resumes.
- The print format settings are as follows:

Font:	Brougham
Type/Style:	Normal
Line space:	Auto
Left/right margins:	0.1 inch –8.1 inches

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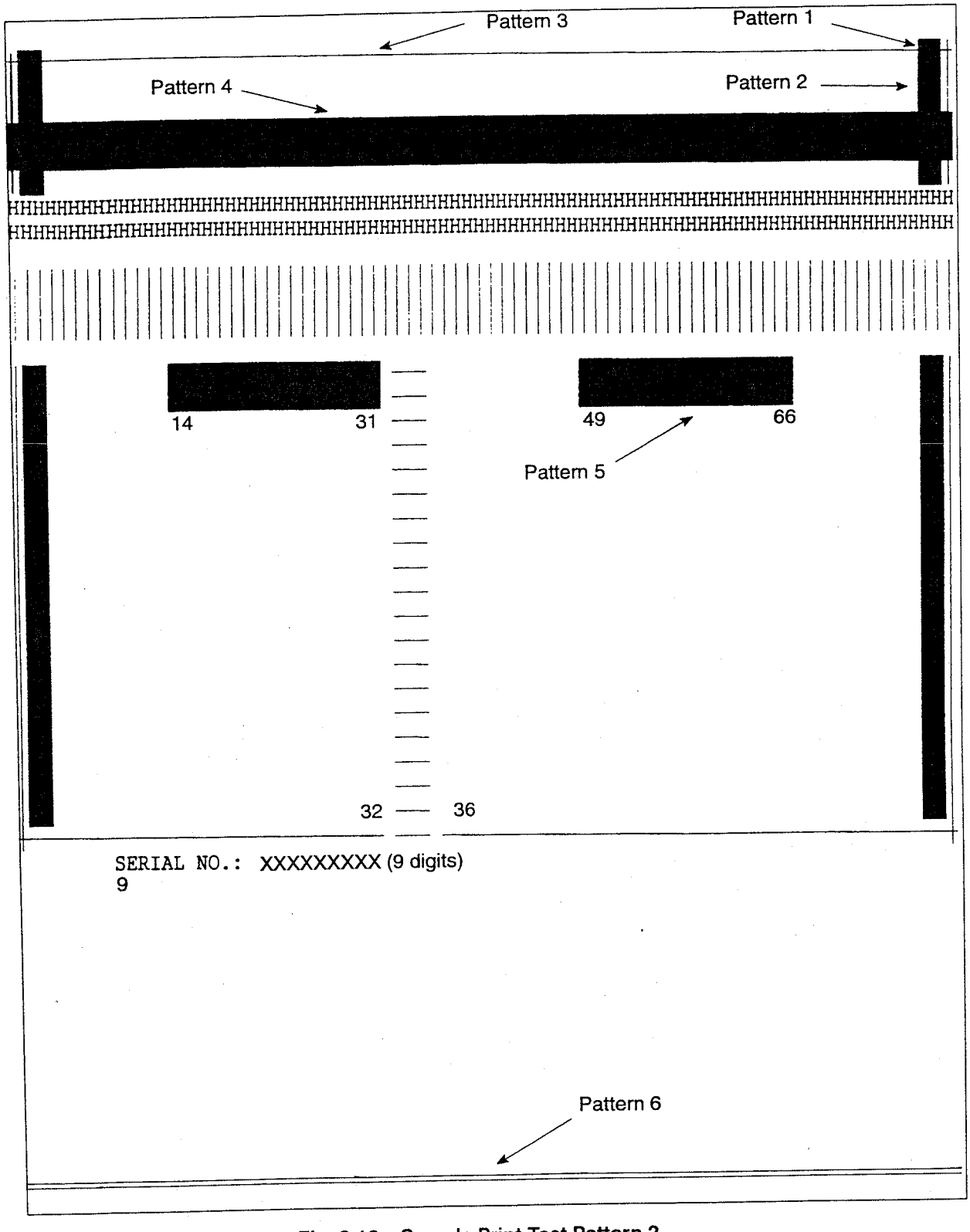

Fig. 3.16 – Sample Print Test Pattern 2

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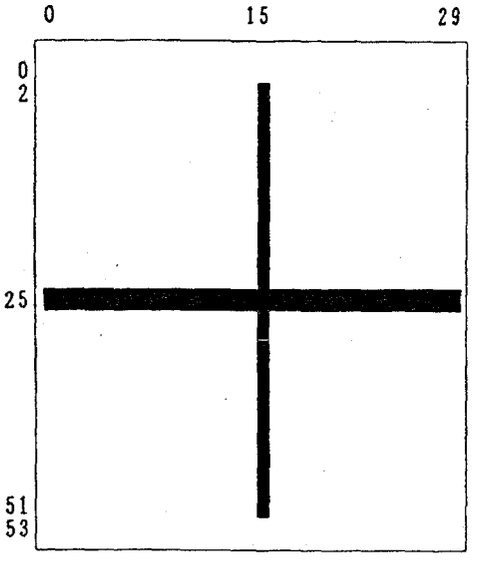
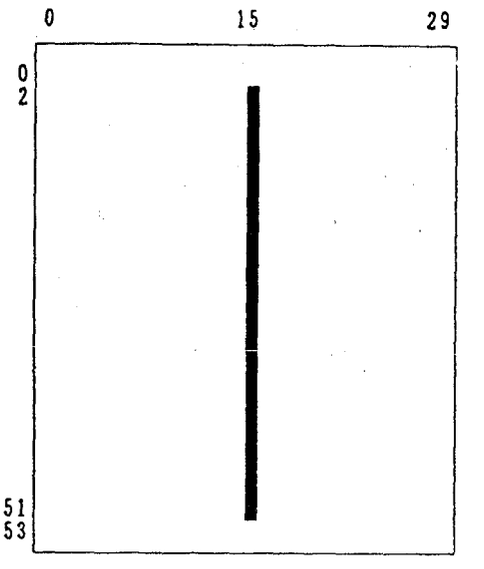
Dot Patterns

The following dot (print) patterns correspond to the print test #2 pattern result on the previous page. See also Fig. 3.16 for the location of each dot pattern type.

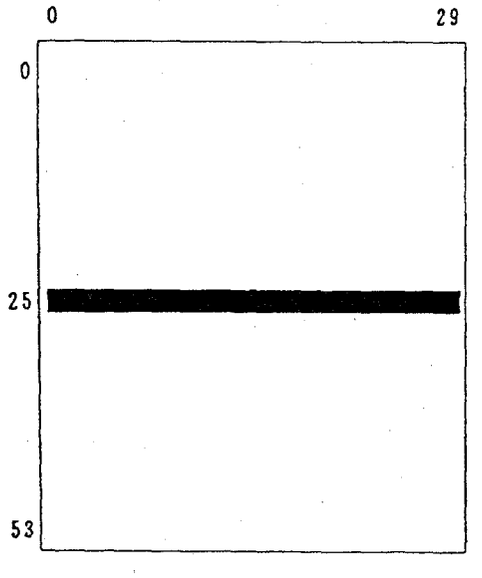
<Pattern 1 >



<Pattern 2 >



<Pattern 3 >



<Pattern 4 >

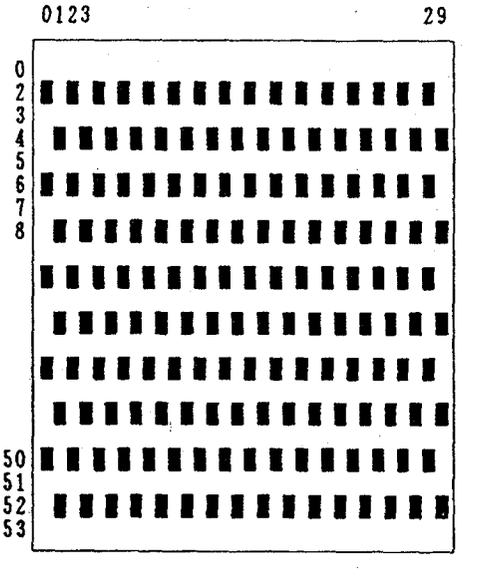


Fig. 3.17 – Dot Patterns for Print Test #2

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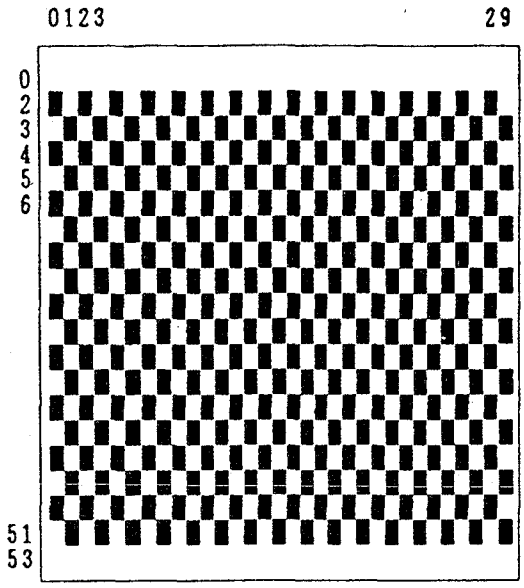
< Pattern 5 >



< Pattern 6 >

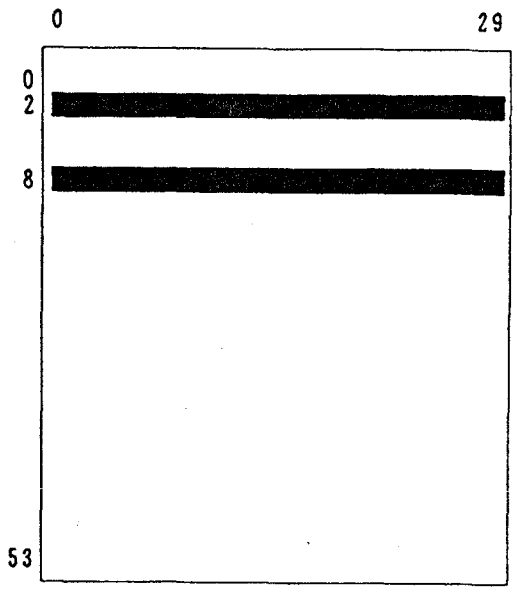


Fig. 3.18 – Dot Patterns for Print Test #2 (Patterns 5 & 6)

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7.3.3 Keyboard Tests

Keyboard Inspection checks that the keys are making proper contact. There are three keyboard self-tests.

(1) Select "4", "5" or "6" from the Self Test menu. If a serial number has not been input before starting the test, the pop-up window will prompt for the serial number; either enter the serial number, or press RETURN to start the test. The display in Fig. 3.19 below indicates that the keyboard test mode has been established.

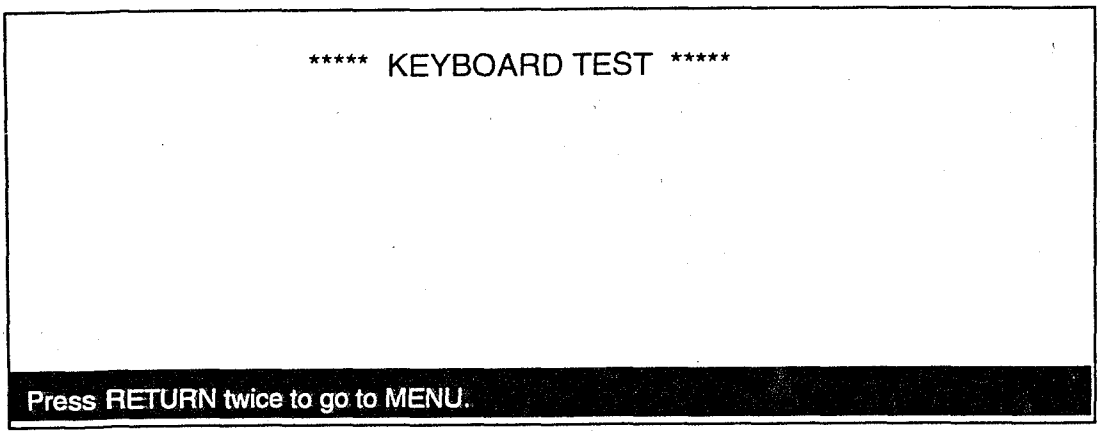

Fig. 3.19 – Keyboard Test #1 Display

NOTE: The location of the keys tested in each test sequence (test 4, 5, or 6) are shown below:

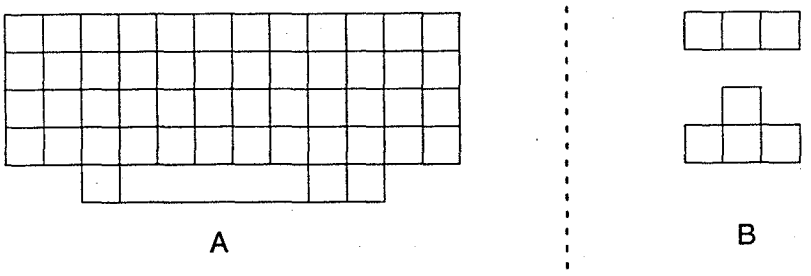

Fig. 3.20 – Keyboard Test Key Locations

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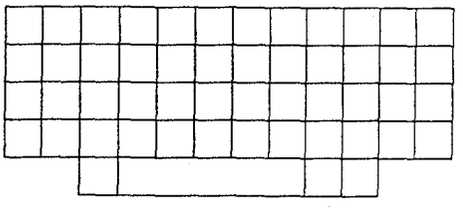
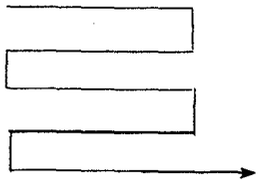
(2) To run Test "4" (all keys in Fig. 3.20, "A"):

a) Starting from the top left of the keyboard, press each key in turn (see sequence in below).

b) Then press SHIFT+Z, SHIFT+/, and CODE+SPACE. If there is no problem, the message "KB TEST OK" will be printed, and the display will return to the Self Test menu.



Test Keys



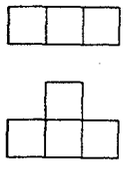
Sequence

NOTES:
- After automatic carrier return, "KB TEST OK." is printed, and the display returns to the Self Test menu.
- A paper check is performed before printing. If paper is set, the print test is executed; if no paper is set, insert paper and press RETURN.
- if the keys are pressed in the wrong sequence, a beep will sound. The test will continue when the correct key is pressed.
- At any time during the test, you may cancel by pressing the RETURN key twice to return to the Self Test menu.

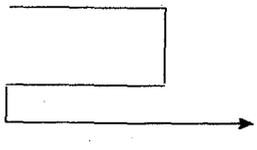
(3) To run Test "5" (all keys in Fig. 3.20, "B"):

a) Press the keys in the sequence indicated below.

b) Then press " ". If there is no problem, the message "KB TEST OK" will be printed, and the display will return to the Self Test menu.



Test Keys



Sequence

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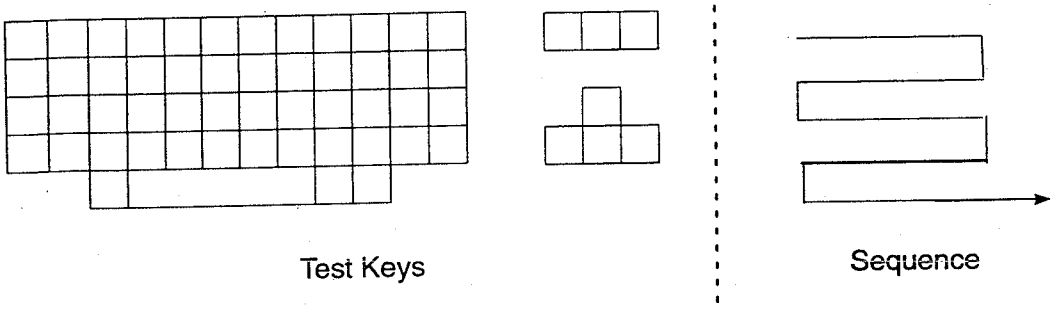
(4) To run Test "6" (all keys in Fig. 3.20, "A" & "B"):

a) Starting from the top left of the keyboard, press all keys ("A" & "B") in the sequence indicated below.

b) Then press SHIFT+Z, SHIFT+/, and CODE+SPACE. If there is no problem, the message "KB TEST OK" will be printed, and the display will return to the Self Test menu.



Test Keys Sequence

NOTES:
- After automatic carrier return, "KB TEST OK." is printed, and the display returns to the Self Test menu.
- A paper check is performed before printing. If paper is set, the print test is executed; if no paper is set, insert paper and press RETURN.
- if the keys are pressed in the wrong sequence, a beep will sound. The test will continue when the correct key is pressed.
- At any time during the test, you may cancel by pressing the RETURN key twice to return to the Self Test menu.

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7.3.4 FDD Tests

There are five tests of the FDD:

1. FDD Test ("7") – checks disk switch, write-protect switch, and other read/write errors
2. Special FDD Test ("8") – checks disk switch, write-protect switch, read/write
3. FDD Switch Test ("9") – checks disk witch and write-protect switch
4. FDD Error Rate Check ("D") – checks for disk writing errors
5. FDD Error Rate Check ("E") – checks for disk reading errors

FDD Test

(1) Insert a non-write-protected diskette in the disk drive, and if necessary, change the "DISK TYPE" (2HD or 2DD) displayed on the Self Test menu to that of the test diskette.

(2) With paper set, select "7" from the Self Test menu. If a serial number has not been input before starting the test, the pop-up window will prompt for the serial number; either enter the serial number and press return, or press RETURN to start the test. *The display as shown below appears, the test results are printed, and the display returns to the Self Test menu.*

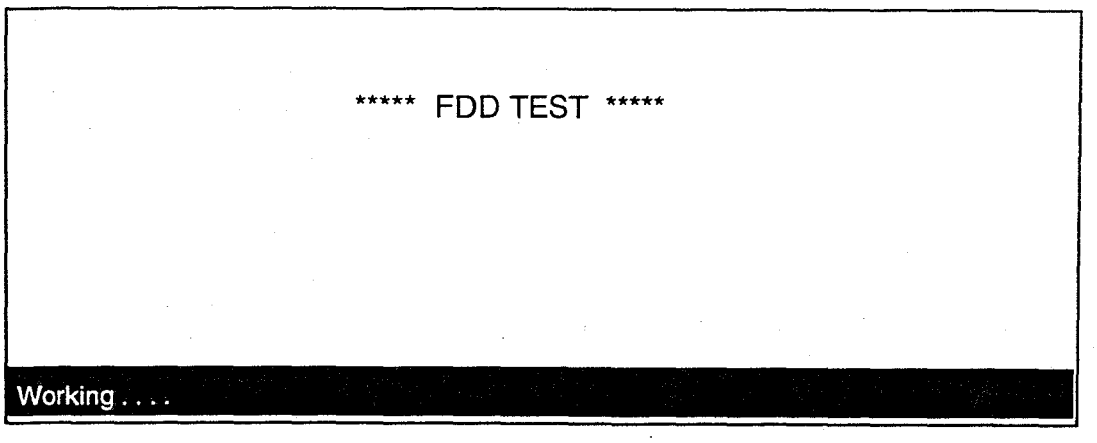

Fig. 3.21 – FDD Test (in progress) Display

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NOTES: • If a key other than the RETURN key is pressed, an error will occur.

- A paper check is always performed before printing; printing will not start until paper is set.
- After completing the disk drive test, the carrier automatically returns and the test result is printed:

SERIAL NO.:	(if it was entered)	
If normal:	DISK TEST OK	DISK TYPE 0 (2DD)
		DISK TYPE 1 (2HD)
If disk switch is defective:		DISK ERROR 01
If write-protect switch is defective:		DISK ERROR O3
If other read/write errors occur:		DISK ERROR OF

Special FDD Test

(1) With paper set and no diskette in the drive, change the "DISK TYPE" (2HD or 2DD) displayed on the Self Test menu to that of the test diskette.

(2) Select "8" from the Self Test menu. (If a serial number has not been input before starting the test, the pop-up window will prompt for the serial number; either enter the serial number and press return, or press RETURN to start the test.) *The display as shown below appears.*

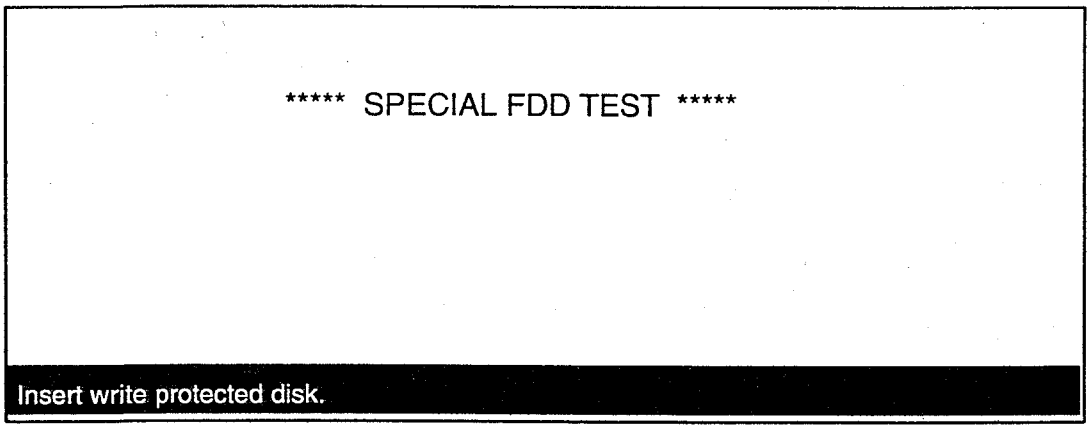

Fig. 3.22 – Special FDD Test Display 1

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(3) When the direction "Insert write protected disk" is displayed, insert a write-protected diskette in the disk drive (if the disk is *not* write-protected, an error will occur). *The display changes to the following:*

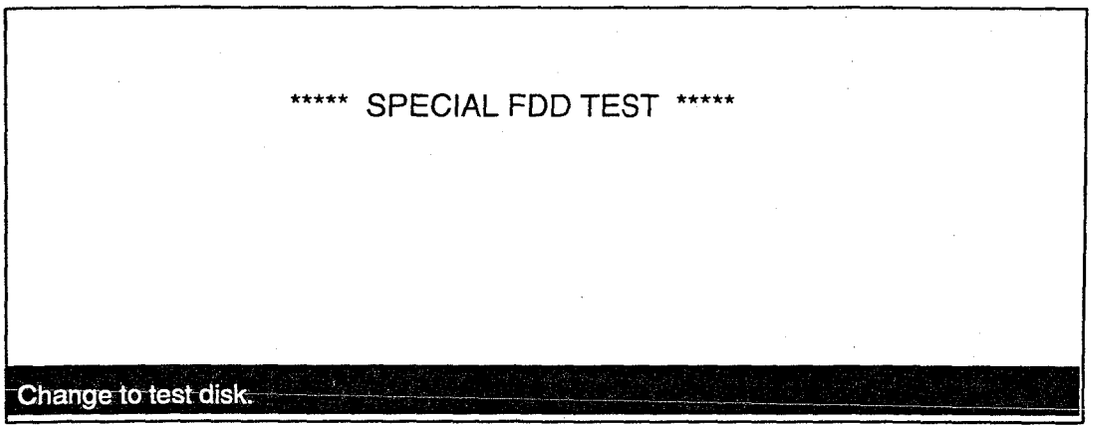

Fig. 3.23 – Special FDD Test Display 2

(4) When the direction "Change to test disk" is displayed, insert a diskette that is not write-protected (if a write-protected diskette is inserted, an error will occur). *The display changes to the one below. A reading and writing check is performed, the test results are printed, and the display returns to the Self Test menu.*

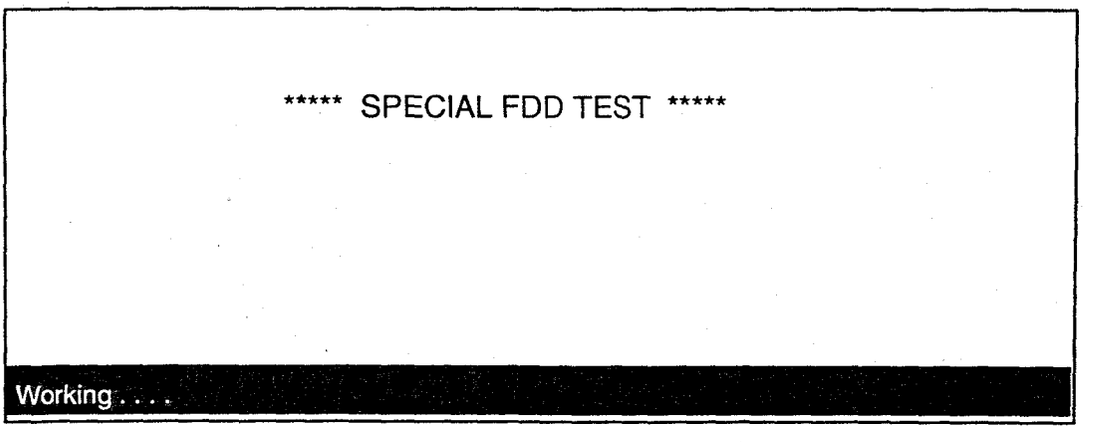

Fig. 3.24 – Special FDD Test (in progress) Display

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NOTES: • After completing the disk drive test, the carrier automatically returns and the test result is printed:

SERIAL NO.: (if it was entered)

If normal:	DISK TEST OK	DISK TYPE 0 (2DD) DISK TYPE 1 (2HD)
If disk switch is defective:	DISK ERROR 01	
If write-protect switch is defective:	DISK ERROR O3	
If other read/write errors occur:	DISK ERROR OF	

• If an error is detected, a two-digit error code is printed: the first digit is the stage number in the test at which the error was detected; the second digit is the type of error as described in the following tables.

STAGE NO.	DESCRIPTION
0	Output of ABORT command Output of SPECIFY command Switching drive motor ON Checking write protect
1	Recalibration Reading SSB3 by means of CHECK DRIVE STATUS command and checking status of track 0 signal Seeking cylinder 1 Reading SSB3 by means of CHECK DEVICE STATUS command and checking status of track 0 signal
2	Seeking cylinder 0 Formatting cylinder 79
3	Formatting cylinder 0
4	Seeking cylinder 39 Formatting cylinder 39
5	Seeking cylinder 79 Formatting cylinder 79
6	Writing data for checking purposes (DB6DB6DB...)
7	Seeking cylinder 39 Writing data for checking purposes (B6DB6DB6...)
8	Seeking cylinder 0 (command = RECALIBRATE) Writing data for checking purposes (6DB6DB6D...)
9	Reading and checking cylinder 0 data
A	Seeking cylinder 39 Reading and checking cylinder 39 data
B	Seeking cylinder 79 Reading and checking cylinder 79 data
C	Recalibration Switching drive motor OFF

Table 3.2 – FDD Special Test Error Stage Codes

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ERROR NO.	DESCRIPTION
1	READY signal has not been detected, although drive motor is ON Disk change signal could not be cleared
2	Disk change detected in the disk change check
3	Write protect error Write protect status detected in the write protect check
6	No ID found No address mark for ID area found No address mark for data area found
A	CRC error at the ID area CRC error at the data area
F	SEEK command or RECALIBRATE command not completed normally IRQ not detected in IRQ waiting status No command or parameter output Data overrun detected End of DMA transfer not detected Number of sectors for which reading/writing requested was 0 Attempt made to access sectors beyond the final sector on the disk Could not receive RESULT CODE

Table 3.3 – FDD Special Test Error Codes

NOTES:
- If an error occurs at any of the steps corresponding to the stage numbers in Table 3.2, only stage C is executed and the check is terminated.
- Formatting, reading, and writing are performed on both sides of the disk.
- To check formatting, the reading verification check is performed.

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FDD SW Test

(1) Without a diskette in the disk drive, select "9" from the Self Test menu. If a serial number has not been input before starting the test, the pop-up window will prompt for the serial number; either enter the serial number and press return, or press RETURN to start the test. *The display as shown below appears.*

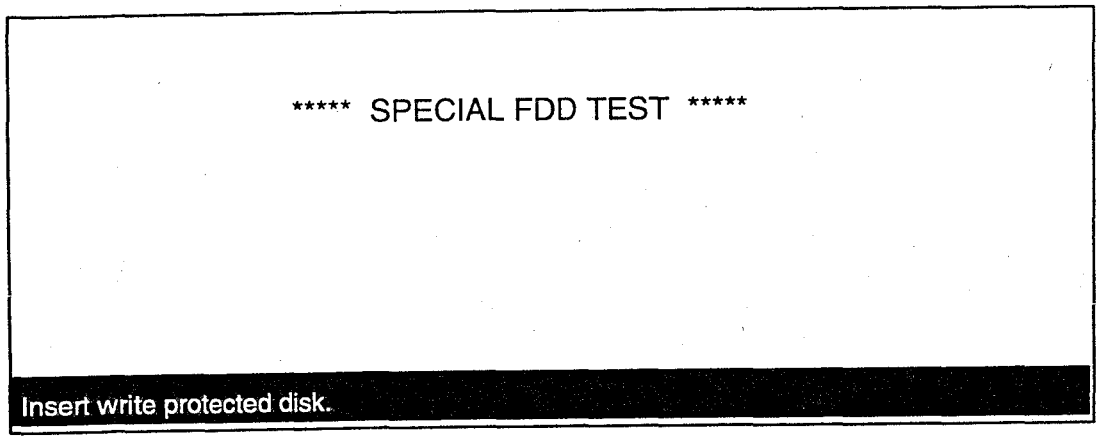

Fig. 3.25 – Special FDD Test Display 1

(2) Insert a diskette with the write-protect tab enabled. *The disk switch is checked, the test results are printed, and the display returns to the Self Test menu (if a diskette that is not write-protected is inserted, an error will occur).*

NOTES: • The test results are printed as shown below:

SERIAL NO.: (if it was entered)

If normal:	DISK TEST OK	DISK TYPE 0 (2DD) DISK TYPE 1 (2HD)
If disk switch is defective:	DISK ERROR 01	
If write-protect switch is defective:	DISK ERROR O3	
If other read/write errors occur:	DISK ERROR OF	

• A paper check is always performed before printing; printing will not start until paper is set.

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FDD Write Error Rate Check

(1) Without a diskette in the disk drive, select "D" from the Self Test menu. (If a serial number has not been input before starting the test, the pop-up window will prompt for the serial number; either enter the serial number and press return, or press RETURN to start the test.) *The display as shown below appears.*

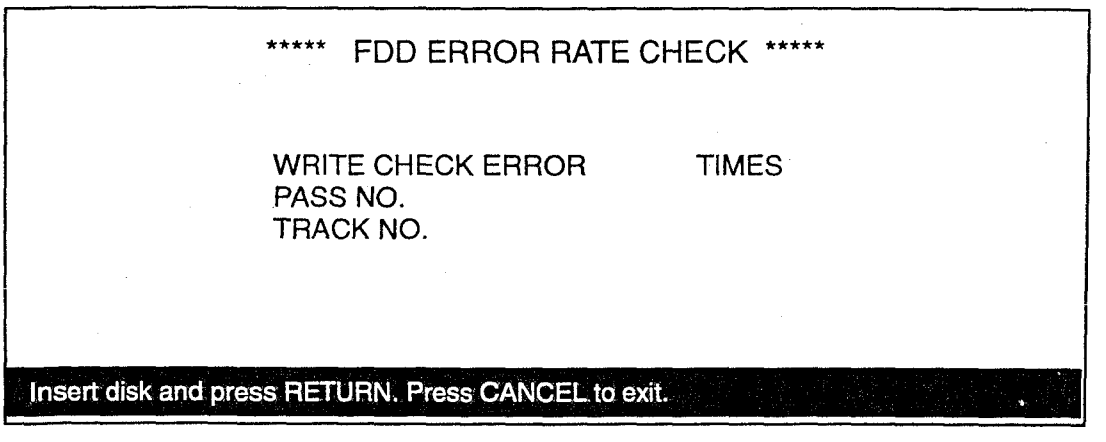

Fig. 3.26 – FDD Write Error Rate Check Display

(2) With paper set, insert a diskette that is not write-protected in the drive and press RETURN. *The screen message changes to "working" during formatting, and 0 is displayed at PASS NO; then the Write Error Rate check is started:*

a) *The diskette is formatted.*

b) *Data "DB6" is repeatedly written on both sides of a randomly designated track.*

c) *The data written above is read (PASS NO. and TRACK NO. are printed if an error occurs).*

d) *Steps (b) and (c) are repeated for all tracks (should not be repeated twice for the same track).*

e) *1 is added to the PASS NO. counter.*

f) *Steps (b) through (e) are repeated 500 times.*

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NOTES: • If an error occurs during checking, PASS NO and TRACK NO are printed, and 1 is added to the counter "WRITE CHECK ERROR XXX TIMES.

• When an error occurs during formatting, formatting ends after the following is printed:

Printout if disk switch is defective:	DISK ERROR 01
Printout if write protect switch is defective:	DISK ERROR 03
Printout if other read/write errors:	DISK ERROR OF

• After the check has run 500 times (or the CANCEL key has been pressed), the following items are printed:

PASS NO. XX *(1–500)*
TRACK NO. XX *(0–79)*
WRITE CHECK ERROR X *(type error)* TIMES XX
SERIAL NO. : XXXXXXXXX *(if a serial no. was input, or blank)*

(if no errors detected):	DISK TEST OK	DISK TYPE 0 (2DD)
	or	
	DISK TEST OK	DISK TYPE 1 (2HD)

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FDD Read Error Rate Check

(1) Without a diskette in the disk drive, select "E" from the Self Test menu. If a serial number has not been input before starting the test, the pop-up window will prompt for the serial number; either enter the serial number and press return, or press RETURN to start the test. *The display as shown below appears.*

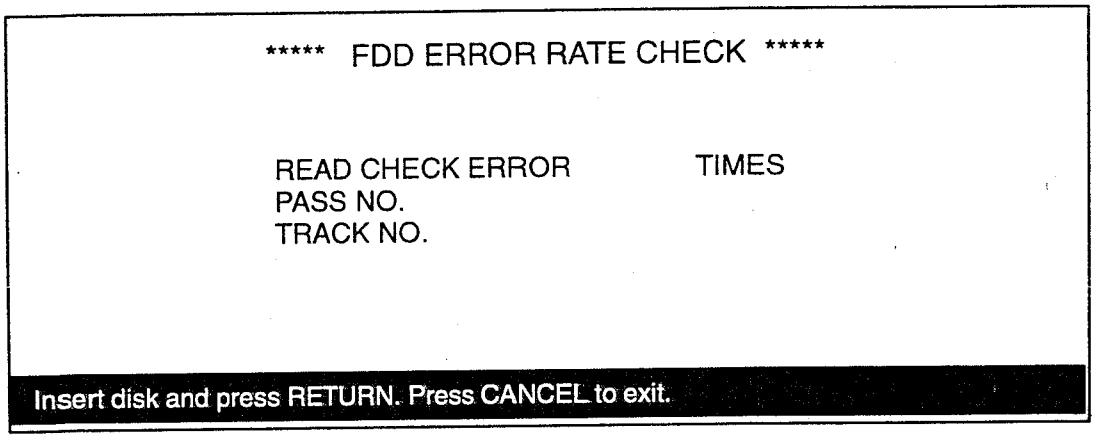

Fig. 3.27 – FDD Read Error Rate Check Display

(2) With paper set, insert a diskette that is not write-protected in the drive and press RETURN. *The screen message changes to "working" during formatting, and 0 is displayed at PASS NO; then the Read Error Rate check is started:*

a) *The diskette is formatted.*

b) *Data "DB6" is written to all daya areas in order, starting with track 0.*

c) *The data on both sides of a randomly designated track is read (PASS NO. and TRACK NO. are printed if an error occurs).*

d) *Step (c) is repeated for all tracks (should not be repeated twice for the same track).*

e) *1 is added to the PASS NO. counter.*

f) *Steps (b) through (e) are repeated 500 times.*

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NOTES: • If an error occurs during checking, PASS NO and TRACK NO are printed, and 1 is added to the counter "READ CHECK ERROR XXX TIMES.

• When an error occurs during formatting, formatting ends after the following is printed:

Printout if disk switch is defective:	DISK ERROR 01
Printout if write protect switch is defective:	DISK ERROR 03
Printout if other read/write errors:	DISK ERROR OF

• After the check has run 500 times (or the CANCEL key has been pressed), the following items are printed:

PASS NO. XX *(1–500)*
TRACK NO. XX *(0–79)*
READ CHECK ERROR X *(type error)* TIMES XX
SERIAL NO. : XXXXXXXXX *(if a serial no. was input, or blank)*

(if no errors detected):	DISK TEST OK	DISK TYPE 0 (2DD)
	or	
	DISK TEST OK	DISK TYPE 1 (2HD)

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7.3.5 PE (Paper End Sensor) Test

The PE test checks that the paper end sensor is working properly by verifying if paper is set or not.

(1) From the Self Test menu, press "A". *The display changes to the following:*

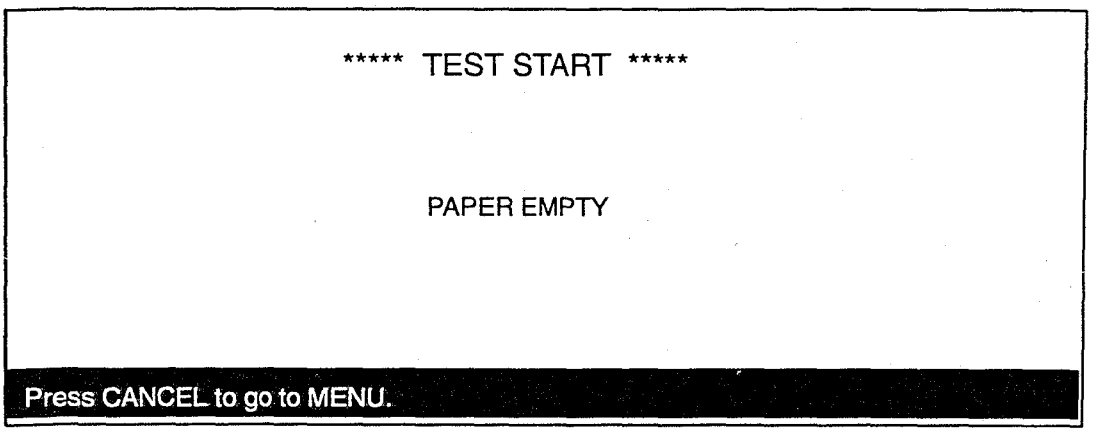

Fig. 3.28 – PE Test Start Display 1

(2) Set paper in the carriage and verify that the screen message changes to the following:

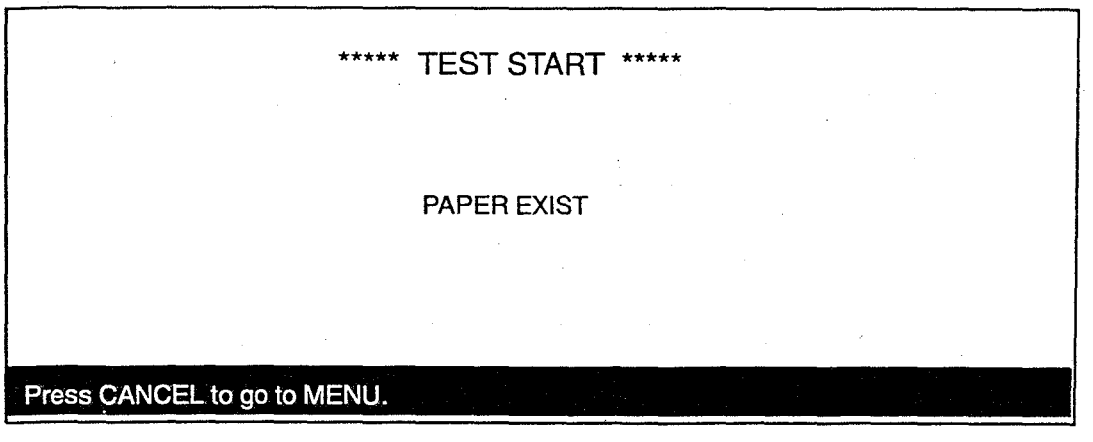

Fig. 3.29 – PE Test Start Display 2

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7.3.6 CR (Carriage Reset) Test

The CR test checks the carriage home position.

(1) From the Self Test menu, press "B". *The following display appears:*

```
***** THE MODE TO ADJUST FOR THE HOME POSITION OF CR *****

        CR PHASE                    OFF
        HP SENSOR:                  OFF

        UP ARROW KEY – Turn CR motor on with 'AB' phase.
        DOWN ARROW KEY – Turn CR motor off.
        LEFT ARROW KEY – Move CR by 1 step in backward direction.
        RIGHT ARROW KEY – Move CR by 1 step in forward direction.

Press RETURN or CANCEL to reset this machine.
```

Fig. 3.30 – CR Test Start Display 1

NOTES: • The following keys may be used to check the CR position as described:

1. UP ARROW key – turns CR motor on with "AB" phase
2. DOWN ARROW key – turns CR motor off
3. LEFT ARROW key – moves CR by 1 step backwards (right to left) (CR phase change direction is AB B BC C CD D DA A).
4. RIGHT ARROW key – moves CR by 1 step forward (left to right) (CR phase change direction is AB A DA D CD C BC B).
5. RETURN or CANCEL key – ends the test (resets the carriage to the default home position and returns to the Main Menu).

• If no keys are pressed within 15 seconds of turning the motor on, the motor is turned off.

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7.3.7 DISK TYPE

The DISK TYPE item on the Self Test menu toggles between 2DD and 2HD (used for specifying which type disk used in FDD tests).

Press "T" from the Self Test menu to change the DISK TYPE from 2DD to 2HD, as appropriate.

7.3.8 CUT SHEET FEEDER

The CUT SHEET FEEDER item on the Self Test menu toggles between OFF (the default) and ON (when a cut sheet feeder is installed). This information is necessary to properly perform the print tests.

Press "U" from the Self Test menu to change the CUT SHEET FEEDER from OFF to ON, as appropriate.

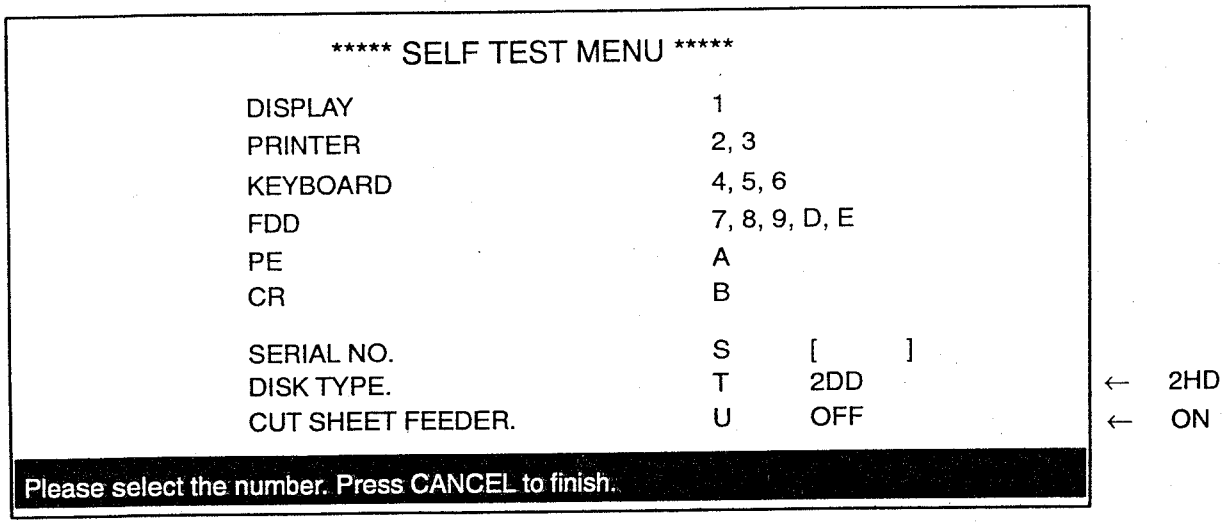
***** SELF TEST MENU *****
DISPLAY 1
PRINTER 2, 3
KEYBOARD 4, 5, 6
FDD 7, 8, 9, D, E
PE A
CR B
SERIAL NO. S [ ]
DISK TYPE. T 2DD ← 2HD
CUT SHEET FEEDER. U OFF ← ON
Please select the number. Press CANCEL to finish.

Fig. 3.31 – Self-Test Menu

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CHAPTER 4 Component Disassembly

1. Covers

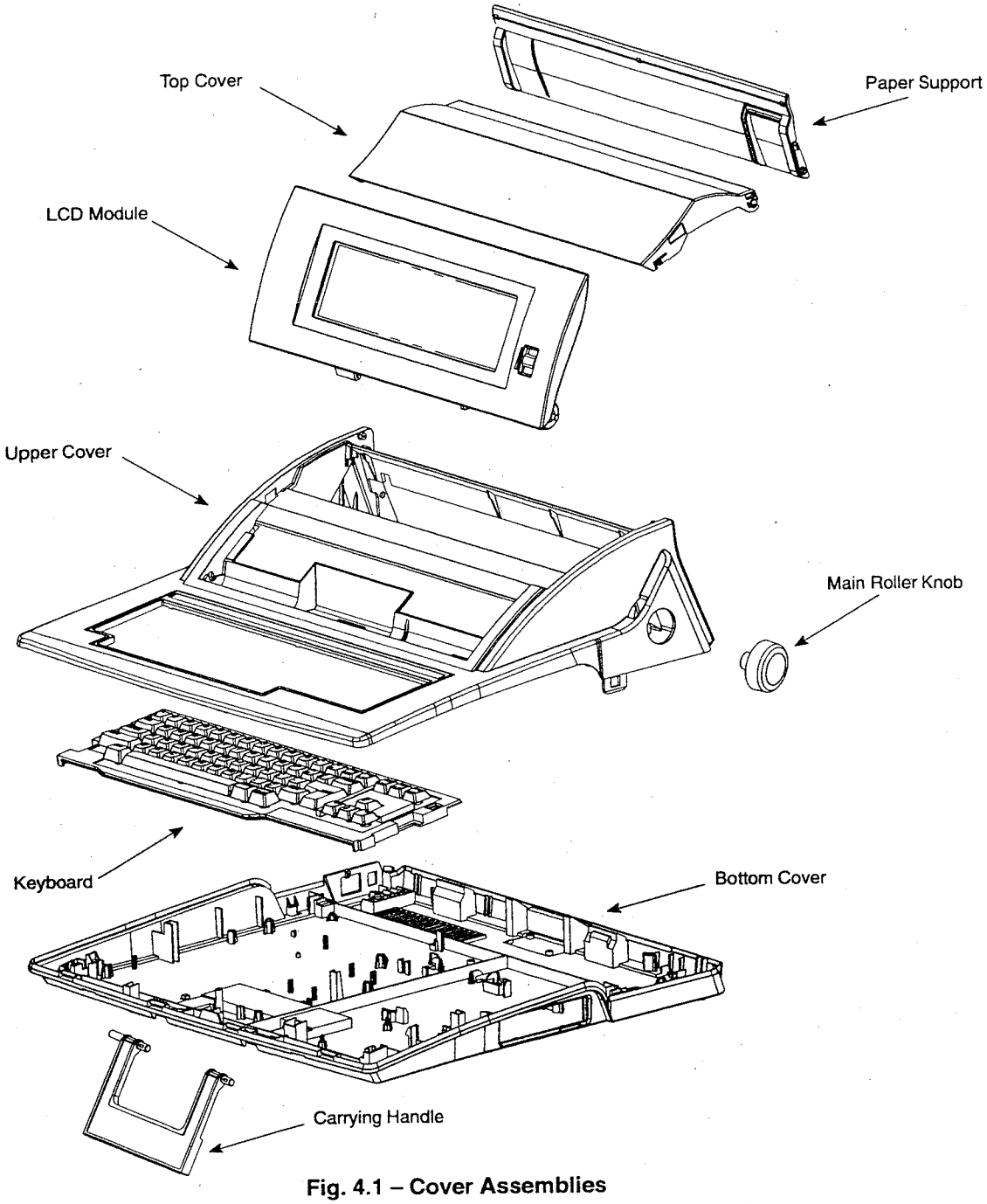

Fig. 4.1 – Cover Assemblies

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CAUTION: Many of the parts are held in place with plastic latches. The latches may break if mishandled. To remove such parts, press the hook end of the latch away from the part to which it is latched.

1.1 Upper Cover

1.1.1 Removal

(1) Turn off the power switch.

(2) Unplug the AC adaptor from the wall outlet, and unplug the adaptor from the machine.

(3) Remove the paper support:

a) Lower the paper support to its fully open position.

b) While holding the middle of the support, carefully apply pressure from the inside of the support until the retaining pin at either side disengages, and then remove the paper support.

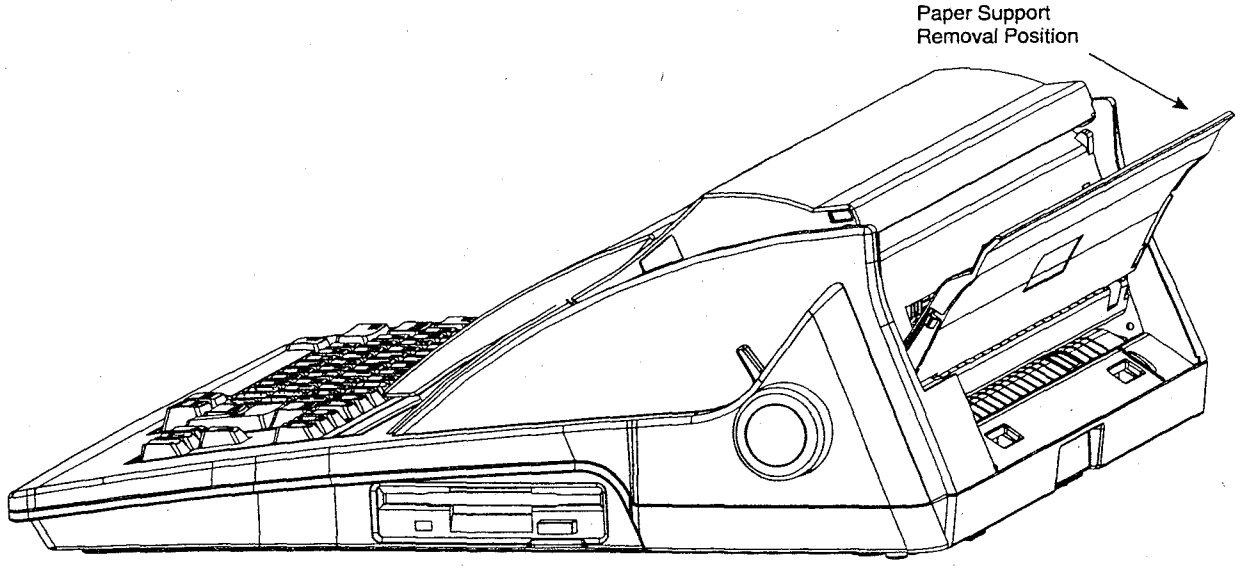

Fig. 4.2 – Paper Support Removal

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(4) Remove the main roller (platen) knob.

(5) Remove the top cover:

NOTE: The top cover fits on tabs on the upper cover.

a) Tilt the LCD to the front to its fully upright position.

b) Open the top cover to about 90° to the base of the machine.

c) With firm, but gentle pressure, lift up to remove the top cover.

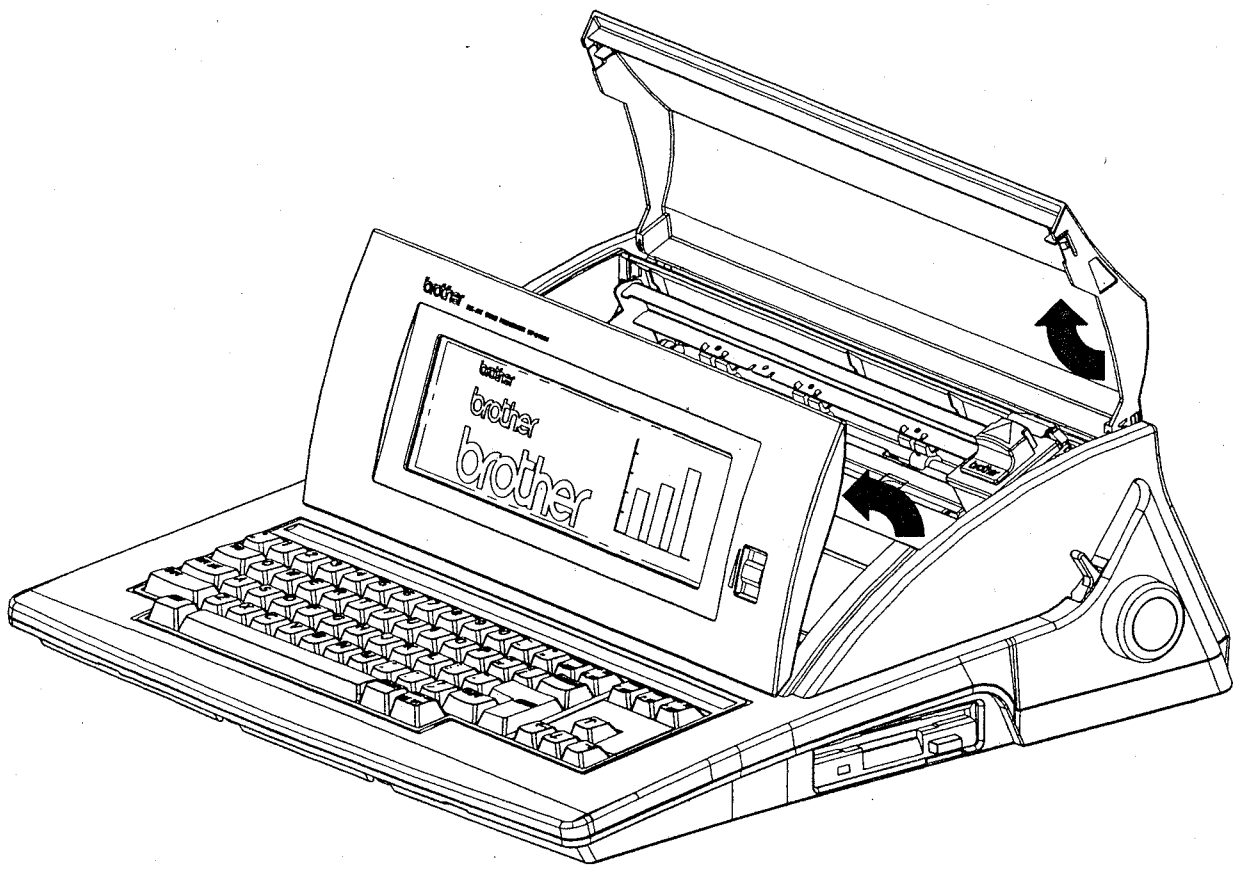

Fig. 4.3 – Top Cover Removal

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(6) Remove the upper cover:

a) Remove the two upper cover screws from the rear of the machine.

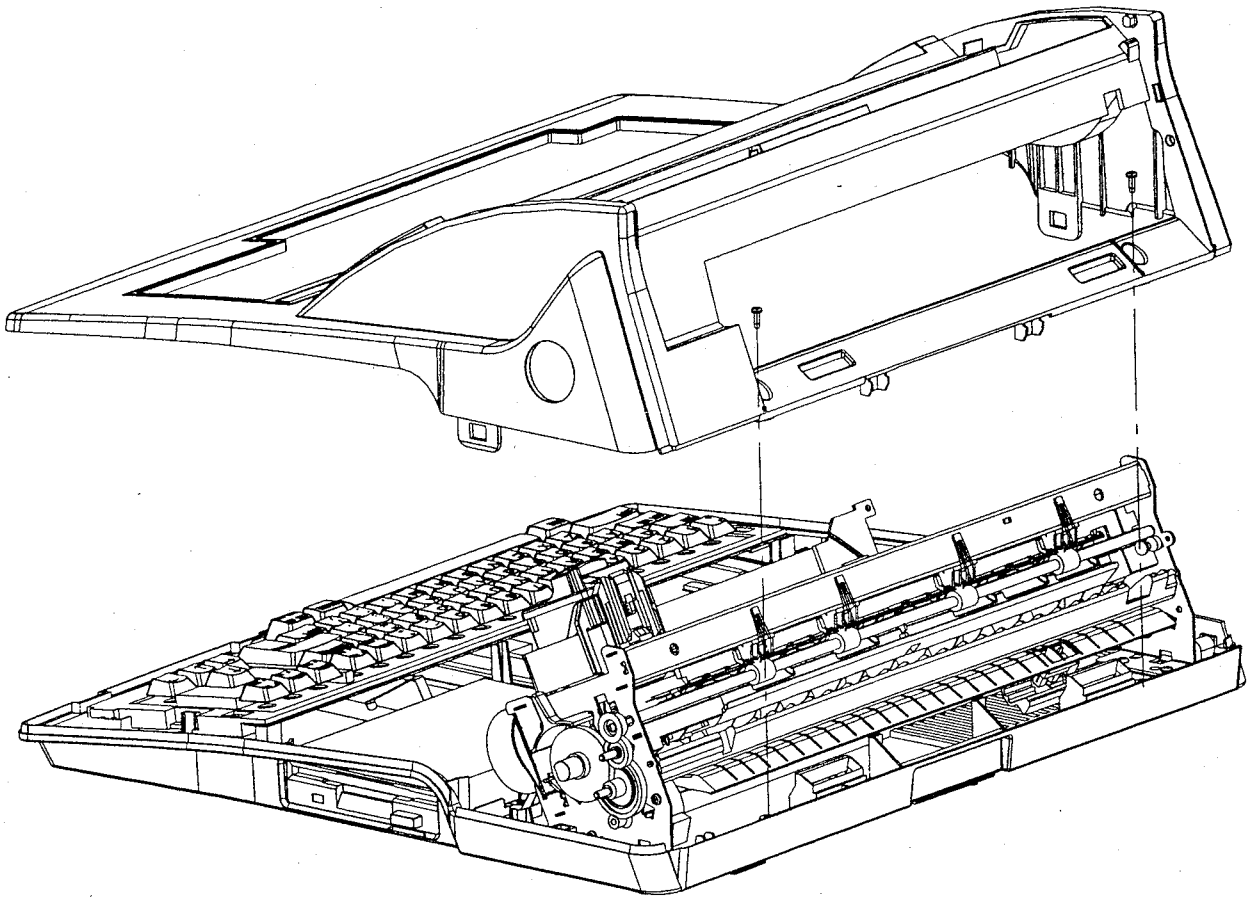

Fig. 4.4 – Upper Cover Removal

b) Unsnap the two retaining tabs at the rear of the upper cover to bottom cover.

c) Tilt the machine to rest on its rear side, with the bottom facing you.

d) On the underside of the bottom cover, locate the opening to the retaining tab (at the rear) on the left and right sides.

e) Insert a flathead screwdriver into the opening between the outer edge of the opening and retaining tab.

f) Apply slight pressure to the retaining tab toward the outer edge of the opening, and separate the upper cover from the bottom cover until the tab is about 1/4 inch clear.

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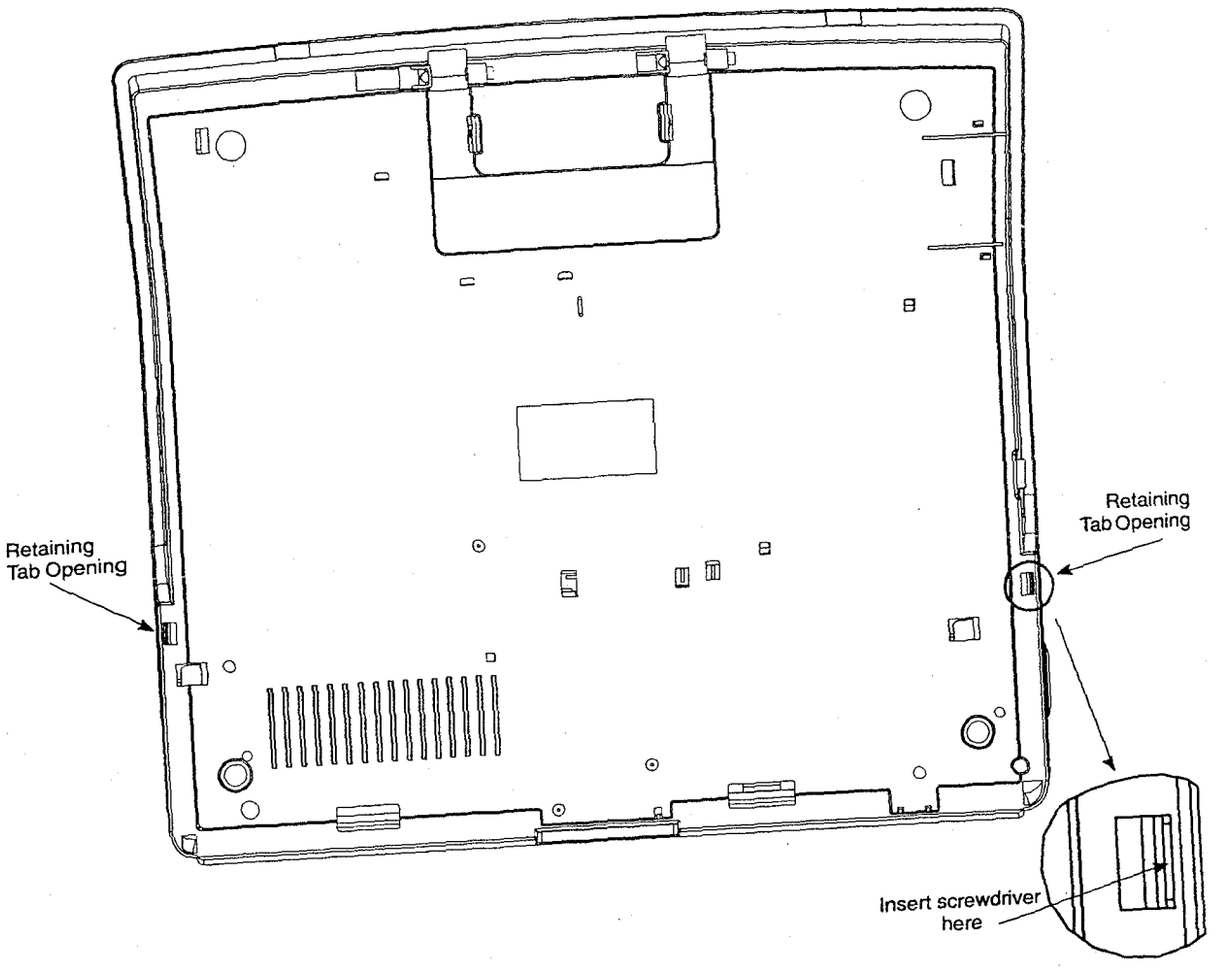

Fig. 4.5 – Access to Upper Cover Retaining Tabs (Underside)

g) Repeat steps (d) through (f) at the other side of the machine bottom.

h) Replace the machine flat (operating position).

i) Pry up on the front of the upper cover at the keyboard to release the four retaining locks that connect the upper cover to the bottom cover.

j) Raise the upper cover to obtain access, and disconnect the LCD harness from the main PCB.

NOTE: For European backlit models, also disconnect the backlight PCB harness from the main PCB.

k) Remove the upper cover from the bottom cover.

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(7) Remove the LCD module (upper cover removed):

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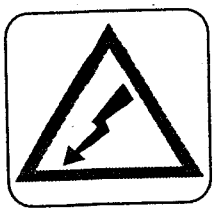

Wear an anti-static wrist strap with ground wire to prevent damage to sensitive electronic components.

a) Tilt the upper cover to rest on its rear side with the inside facing you.

b) Unhook the LCD harness core from the wire hook on the underside of the upper cover.

c) Locate the opening on the right side (about 2/3 of the length up) where you can see the underside of the LCD.

d) Locate the retaining tab over the metal retaining pin in the upper cover.

e) Carefully apply slight pressure to deflect the retaining tab down until it clears the retaining pin, and push the pin until it clears the hole in the upper cover (do not remove the pin).

f) Lay the upper cover flat (underside down), and lift up on the right side of the LCD and slide it to the right and up to remove it from the upper cover.

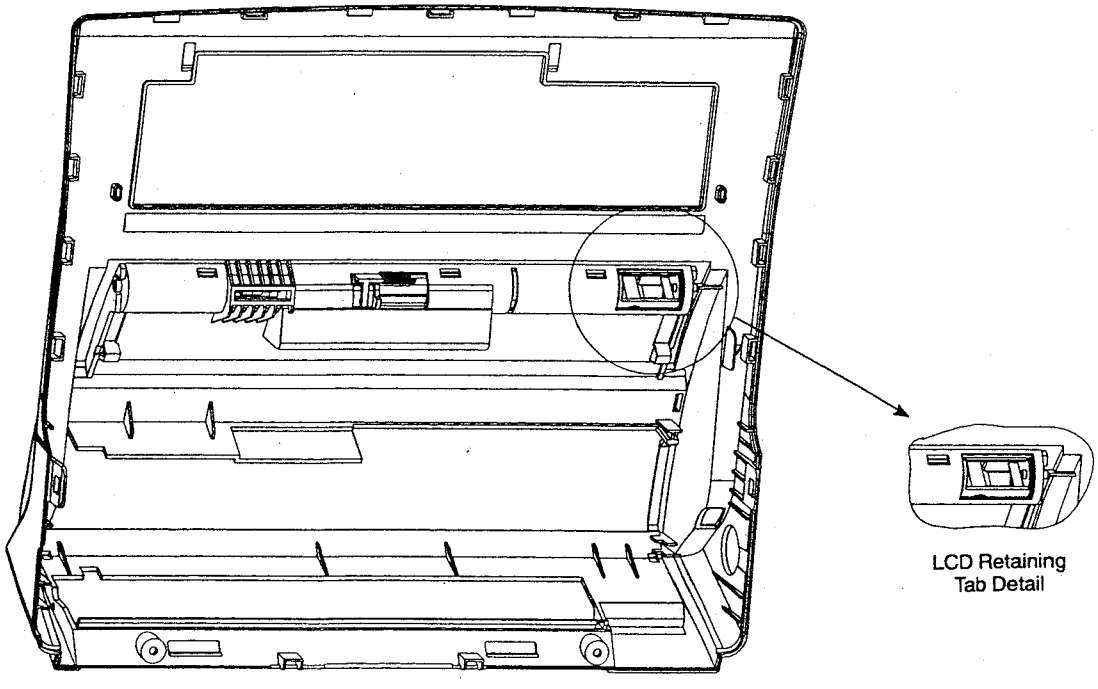

Fig. 4.6 – LCD Removal

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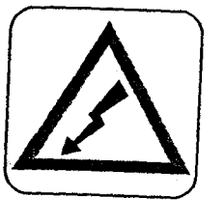
1.1.2 Upper Cover Reassembly

CAUTION: Electro-Static Discharge Hazard



Wear an anti-static wrist strap with ground wire to prevent damage to sensitive electronic components.

(1) Install the LCD module into the upper cover.

a) Put the LCD harness through the opening in the upper cover.

NOTE: For European backlit models, put the backlight PCB harness through the upper cover opening.

b) Place the LCD module into the recessed slot in the upper cover, and insert the hinge in its slot and the left (plastic) retaining pin in the hole in the upper cover.

c) Turn the upper cover upside-down, and push the metal retaining pin through the hole until it contacts the stopper on the right side of the upper cover, and the retaining tab secures it.

d) Place the LCD harness with core into the hook on the underside of the upper cover.

NOTE: For European backlit models, also replace the backlight PCB harness into the hook.

(2) While holding the upper cover assembly over the machine, connect the LCD harness to the main PCB.

(3) Place the upper cover on the bottom cover, and beginning in the middle of each side, apply pressure on the upper cover to engage the left and right hooks.

(4) Apply pressure to the rear of the upper cover to engage the two rear locks, then to the front of the upper cover to lock the four front locks (keyboard side).

NOTE: Make sure that the LCD harness is still locked into the hook on the underside of the upper cover, that it is not pinched between the keyboard and any covers, and that all locks are properly engaged.

(5) Replace the two upper cover clamp screws.

(6) Reinstall the top cover, the paper support, and the main roller knob.

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1.2 Carrying Handle

1.2.1 Removal

(1) Place the machine on its rear side with the underside facing you.

(2) Turn the carrying handle perpendicular to the bottom cover.

(3) While pushing the carrying handle to the left, press in on each of the two stoppers with a small screwdriver to disengage the handle pivot shaft from the stoppers.

(4) Slide the handle fully to the left to clear the locks in the bottom cover, and pull it toward you.

1.2.2 Installation

(1) Turn the handle perpendicular to the bottom cover, and slide the left pivot shaft into its hole in the left side of the bottom cover.

(2) Align the right pivot shaft with its hole at the right side, and slide the handle to the right until the stoppers engage the locks.

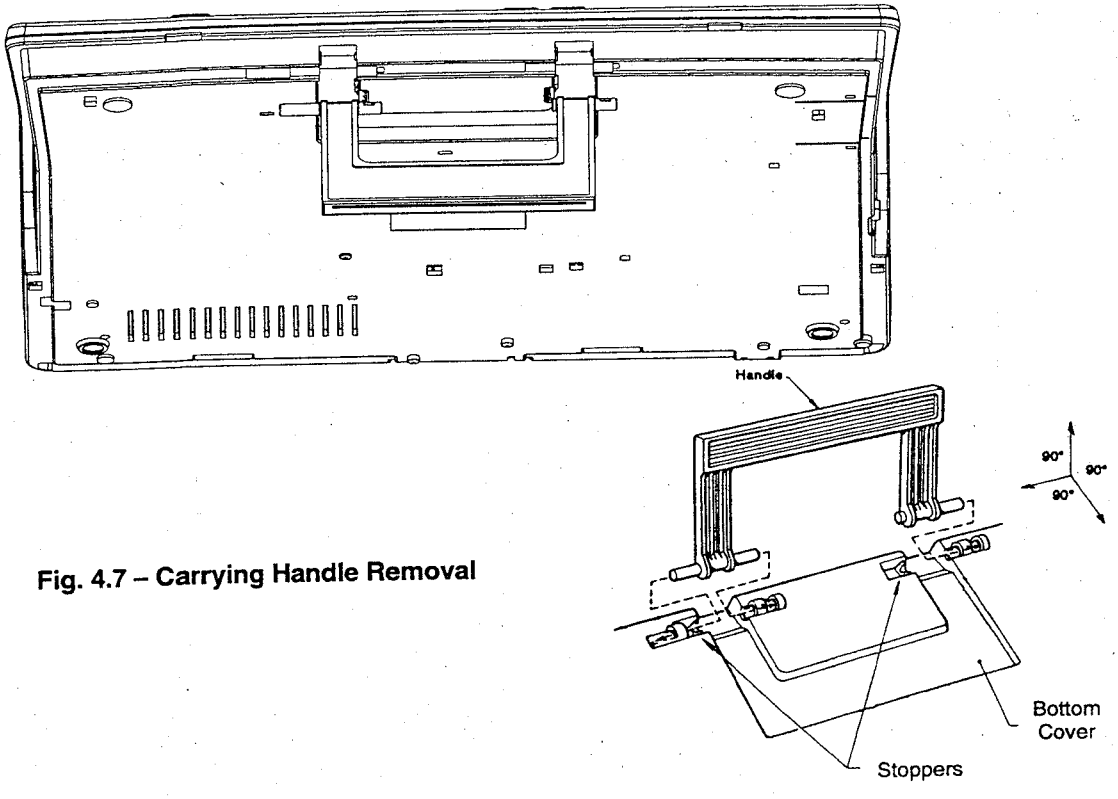

Fig. 4.7 – Carrying Handle Removal

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2. LCD Module

2.1 LCD Disassembly

The LCD module has three main parts: the LCD upper cover, the LCD PCB, and the LCD lower cover.

(1) With the LCD module removed from the upper cover, place the LCD face down (screen side down).

(2) Remove the LCD lower cover:

a) Remove the two Taptite screws securing the lower cover to the upper cover and PCB section, and lift off the lower cover.

b) At each side of the LCD, carefully pry the lower cover up with a screwdriver until the two retaining tabs at each side clear the edge of the upper cover.

c) Release the four retaining tabs that secure the top side (opposite hinge side) of the lower cover (carefully pry open the tabs in the four slots if necessary).

d) With all six tabs released (2 each side and 4 top), rotate the lower cover up to unsnap the three retainers at the bottom (hinge) side of the lower cover, and remove the LCD lower cover.

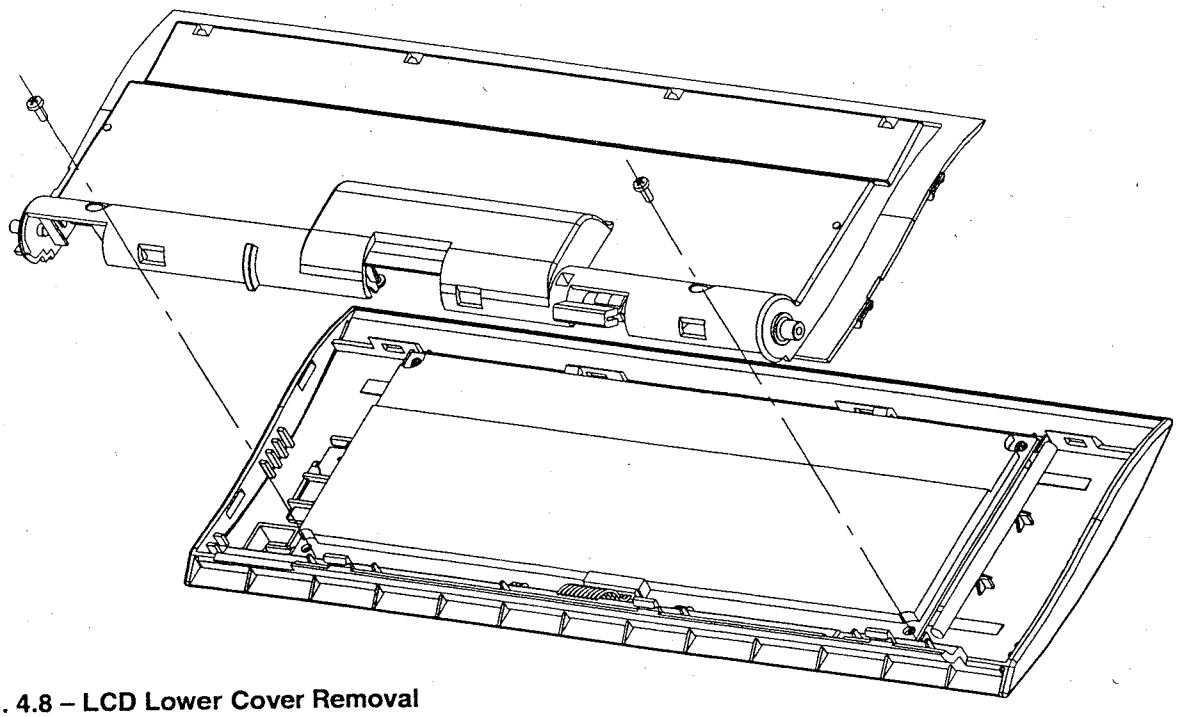

Fig. 4.8 – LCD Lower Cover Removal

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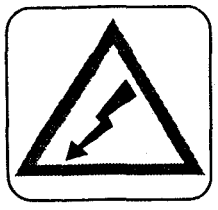
(3) Remove the LCD PCB:

CAUTION: Electro-Static Discharge Hazard



Wear an anti-static wrist strap with ground wire to prevent damage to sensitive electronic components.

a) Carefully pry up on the bottom of the LCD PCB (hinge side of upper cover) to release the two retaining tabs in the LCD upper cover.

b) Rotate the bottom of the LCD PCB up (about 45°) to clear the two retaining posts at the ends of the top of the PCB and LCD upper cover.

c) Gently pull the PCB toward you to clear the two retaining tabs at the top of the PCB and upper cover.

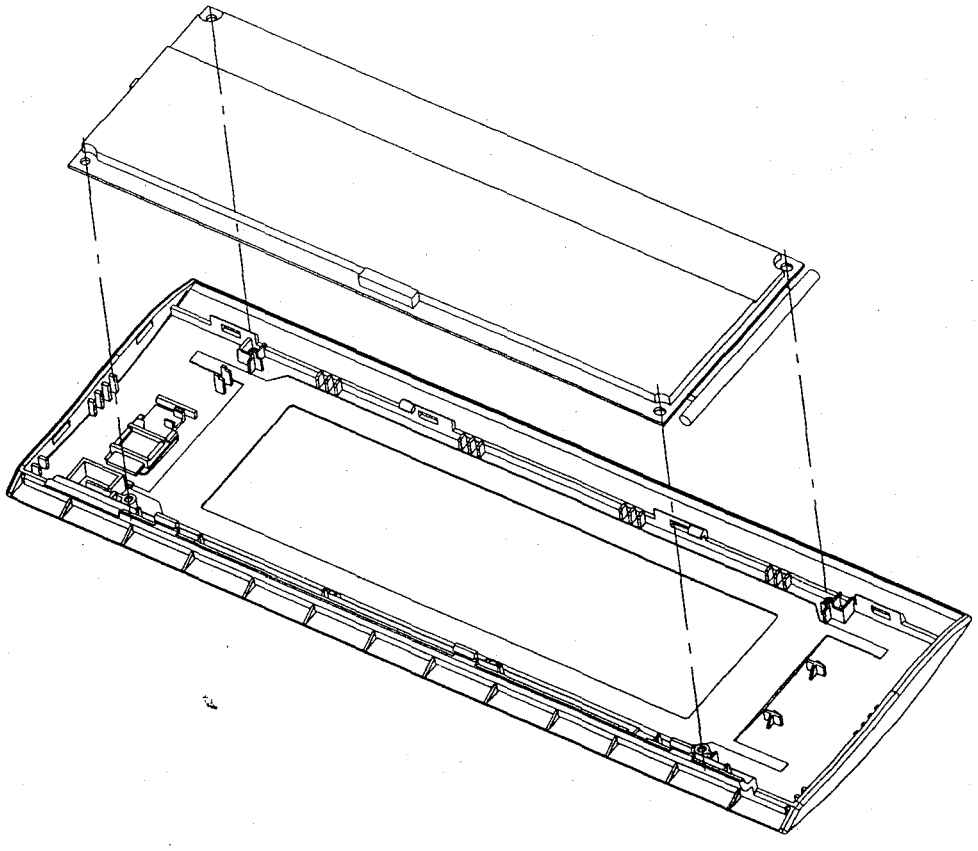


Fig. 4.9 – LCD PCB Removal

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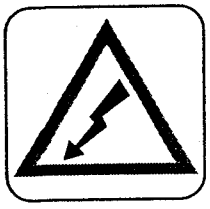
2.2 LCD Module Reassembly

CAUTION: Electro-Static Discharge Hazard
Wear an anti-static wrist strap with ground wire to prevent damage to sensitive electronic components.



(1) Install the LCD PCB into the LCD upper cover:

a) On the LCD upper cover, slide the contrast controller all the way up (toward the top side of the cover), and slide the black contrast controller on the LCD PCB all the way up.

b) Holding the LCD PCB at about a 45° angle, slide the top edge of the PCB under the two retaining tabs in the top of the LCD upper cover, and align the hole at each end with the posts in the upper cover.

c) Carefully lower the bottom edge of the PCB onto the LCD upper cover; then apply slight pressure toward the center of the PCB at the retaining tabs to snap the bottom edge of the PCB under the two tabs.

d) Check that the holes for the LCD lower cover screws are aligned, and that the black LCD contrast slider is between the retainers in the LCD upper cover contrast controller.

(2) Plug the LCD harness into the LCD PCB.

(3) Install the LCD lower cover:

a) Holding the LCD lower cover at about 45° to the LCD upper cover, engage the three retaining tabs in the upper cover (hinge side) with the slots in the LCD lower cover.

b) Applying slight pressure at the hinge side of the lower cover, rotate the top of the lower cover down to engage the retainers at the sides and top of the LCD upper cover.

c) If necessary, apply pressure to each side and to the top of both covers to snap them together.

(4) Replace the two Taptite screws in the bottom of the LCD lower cover.

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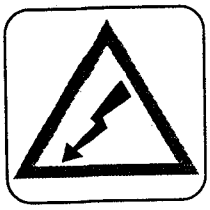
3. Keyboard Assembly

CAUTION: Electro-Static Discharge Hazard
Wear an anti-static wrist strap with ground wire to prevent damage to sensitive electronic components.



3.1 Keyboard Removal

(1) Turn off the power and unplug the power cord.

(2) Remove the paper support, top cover, and the upper cover.

(3) Press outward on the two clips (one on each side of the keyboard), lift up on the keyboard panel to just clear the bottom cover keyboard supports, and unplug the keyboard PCB harness from the main PCB (left side).

NOTE: The keyboard PCB and the base plate are attached to the bottom of the keyboard, and are not removable (entire assembly must be replaced).

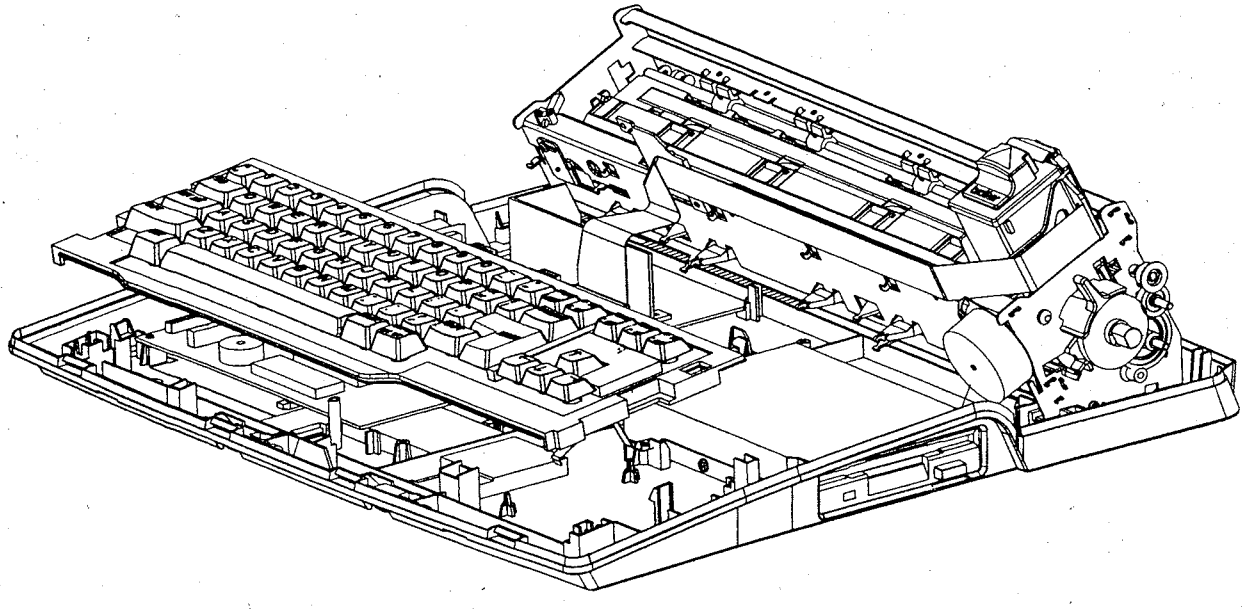


Fig. 4.10 – Keyboard Assembly Removal

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3.2 Keyboard Installation

Place the keyboard in the bottom cover onto the keyboard supports, plug the keyboard PCB harness into the main PCB, and push down on each side of the keyboard to snap it into place.

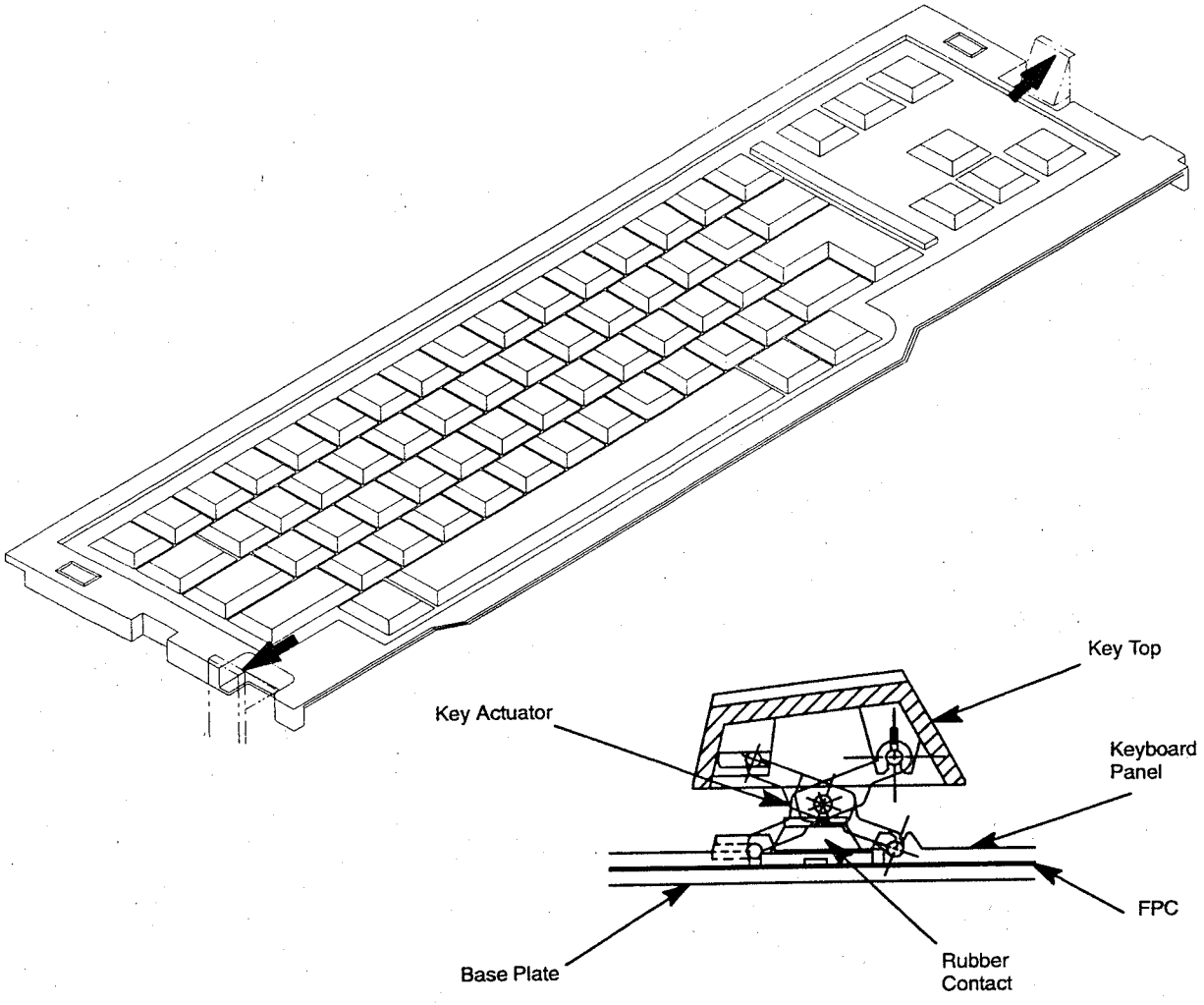

Fig. 4.11 – Keyboard Installation

4. Ink Jet Printer Assembly

The ink jet printer assembly is attached to the rear of the bottom cover by two screws.

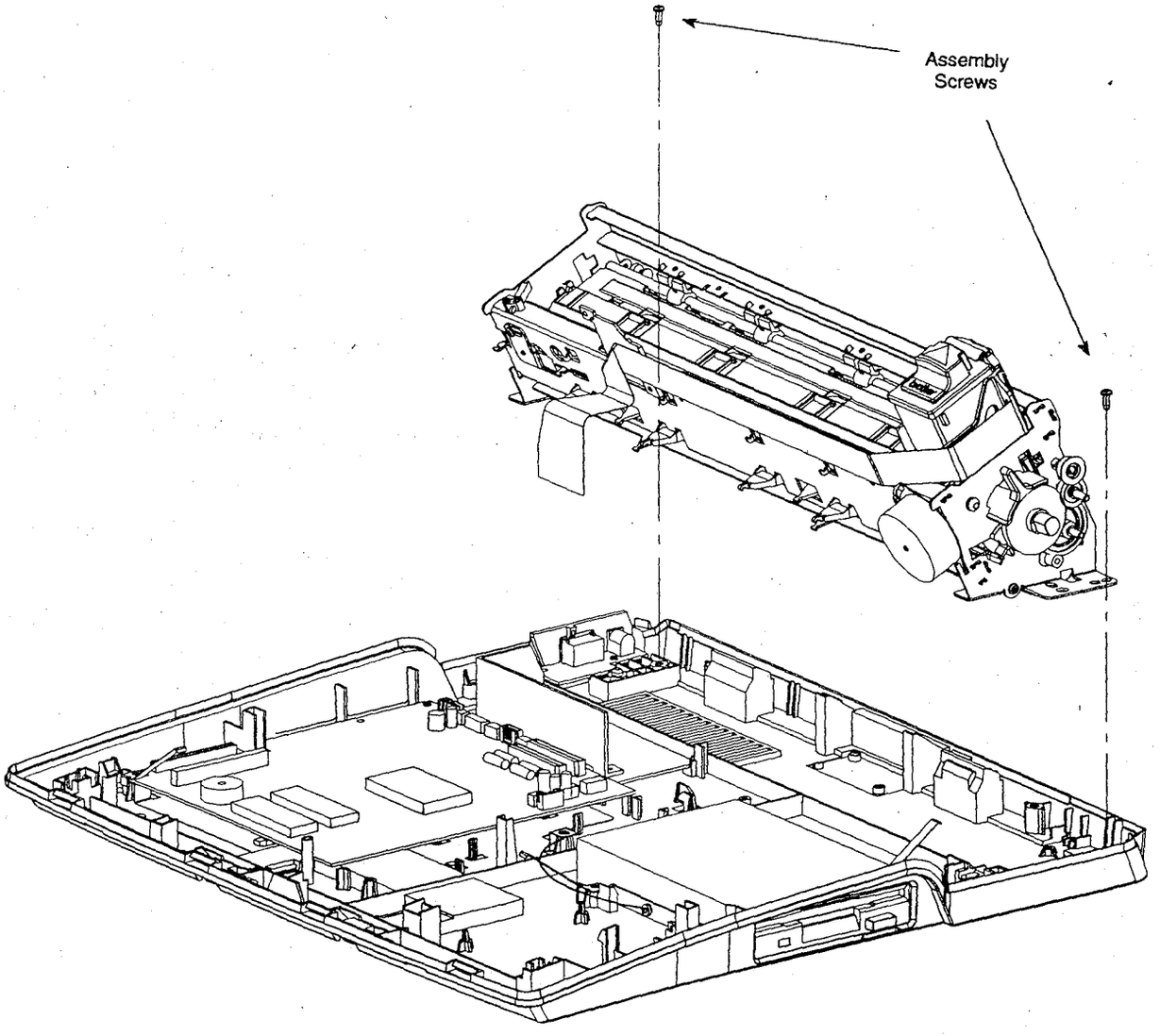

Fig. 4.12 – Ink Jet Printer Assembly

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4.1 Ink Jet Printer Removal

(1) Remove the upper cover (paper support, top cover, upper cover with LCD module, and main roller knob).

(2) Disconnect the six connectors from the main PCB:

- 2 flat cables (to carriage)
- home position sensor harness
- paper end sensor harness
- 2 motor harnesses (carriage motor & line feed motor)

NOTE: Remove the motor harnesses from the harness retainers in the bottom cover.

(3) Disconnect the ground wire from the printer.

(4) Remove the two screws from the rear of the printer mechanism.

(5) While lifting up on the printer frame to clear it from the rear alignment posts, slide the ink jet printer assembly toward the rear of the machine, and lift it up and out of the bottom cover.

4.2 Ink Jet Printer Installation

(1) Slide the front of the printer assembly into the catches in the bottom cover, and set the rear of the assembly onto the alignment posts.

(2) Connect the ground wire.

(3) Connect the six connectors to the main PCB, and route the motor harness into the retainers in the bottom cover.

(4) Install the two screws at the rear of the printer mechanism.

(5) Install the upper cover assembly (upper cover with LCD, top cover, paper support, and main roller knob).

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4.3 Printer Disassembly

This section describes the procedures for removal and disassembly of all printer mechanism components and assemblies: carriage, timing belt & motor, line feed assembly, top paper guide, star-wheel assembly, star-wheel exit roller assembly, paper separator, paper adjustment lever, main paper guide & maintenance station, main roller assembly, main paper pan, and paper pressure plate.

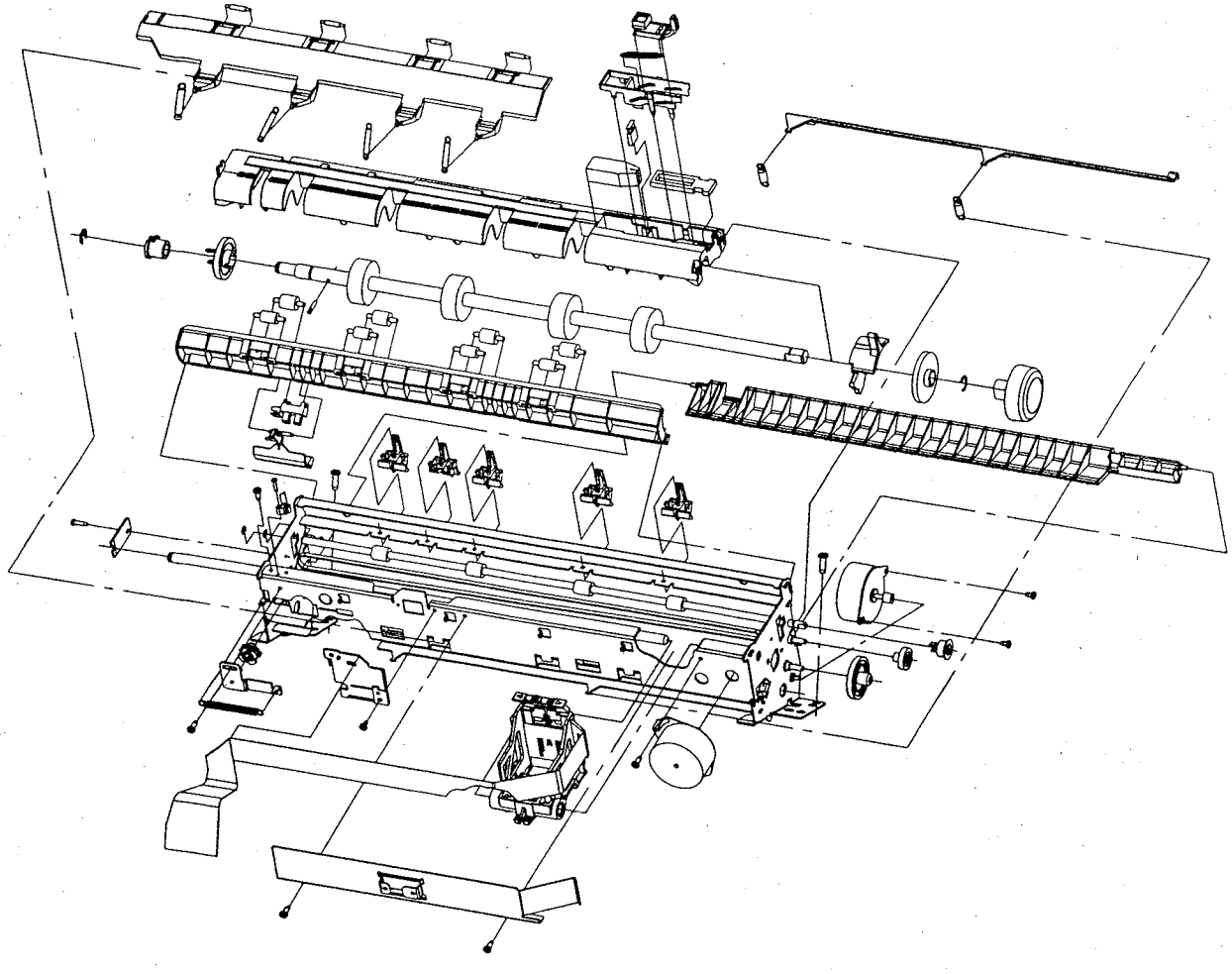

Fig. 4.13 – Ink Jet Printer Mechanism (exploded view)

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4.3.1 Carriage Removal

(1) If necessary, remove the ink cartridge and store it in a safe place.

(2) Loosen the idle pulley bracket screw and remove the spring to release the tension on the timing belt.

(3) Remove the screw from the main shaft stopper, and remove the stopper.

(4) Remove the main shaft (from the left end).

(5) Disengage the carriage from the carriage rail and from the drive (timing) belt.

(6) Remove the cable holder and screw from the printer frame, and lift the carriage assembly from the frame.

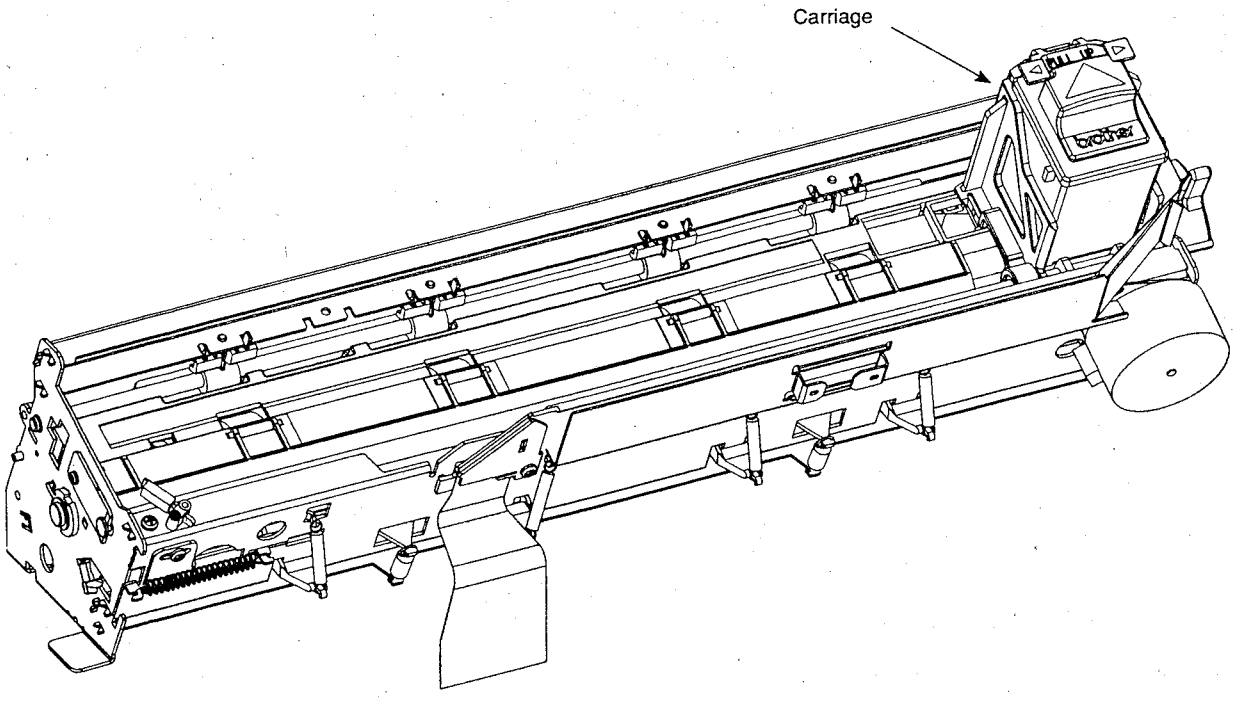

Fig. 4.14 – Printer Mechanism

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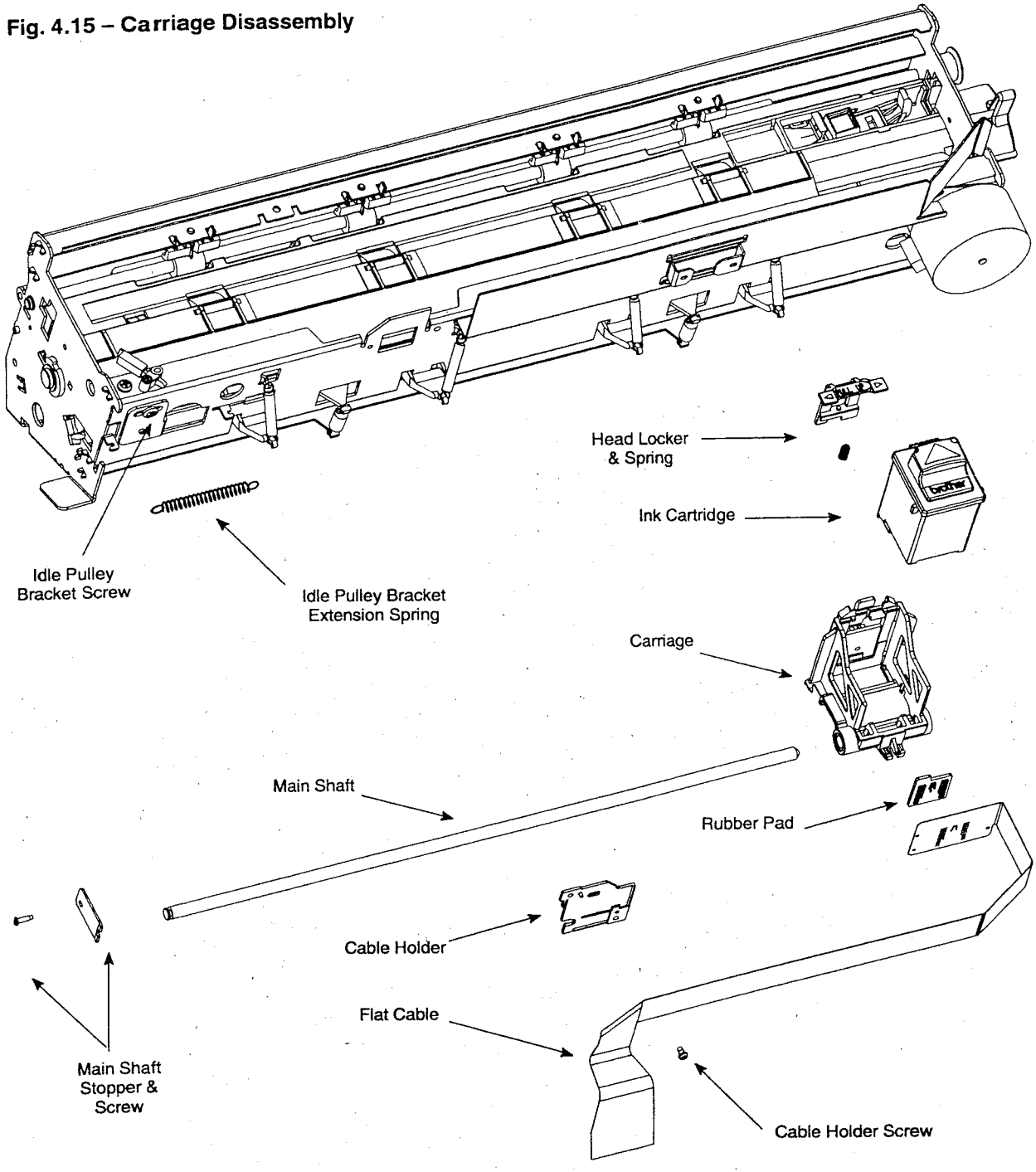
Fig. 4.15 – Carriage Disassembly



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4.3.2 Carriage Transport Belt & Motor Removal

(1) Remove the idle pulley bracket screw, and remove the idle pulley bracket and pulley.

(2) Remove the timing belt.

(3) Remove the carriage motor.

NOTE: Upon reassembly of the belt and/or the motor, carriage home position adjustment and carriage tension check are required. See section 4.4.

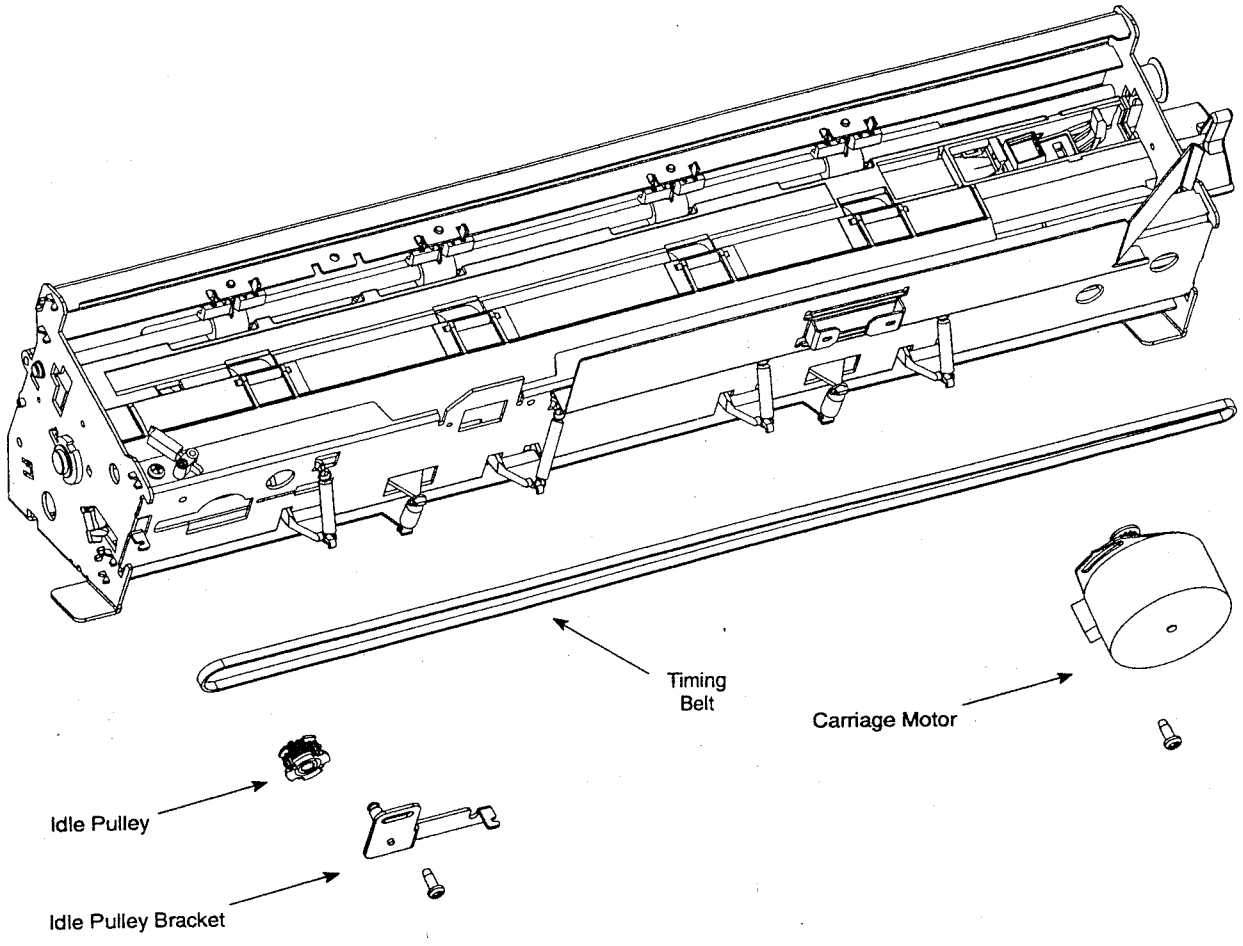

Fig. 4.16 – Carriage Transport Belt & Motor Removal

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4.3.3 Line Feed Assembly Removal

(1) Remove the C-clip from the main roller shaft.

(2) Remove the main roller gear from the main roller shaft.

(3) Remove the star-wheel roller gear from the star-wheel roller shaft.

(4) Remove the two (large & small) idle gears from their shafts.

(5) Remove the line feed motor.

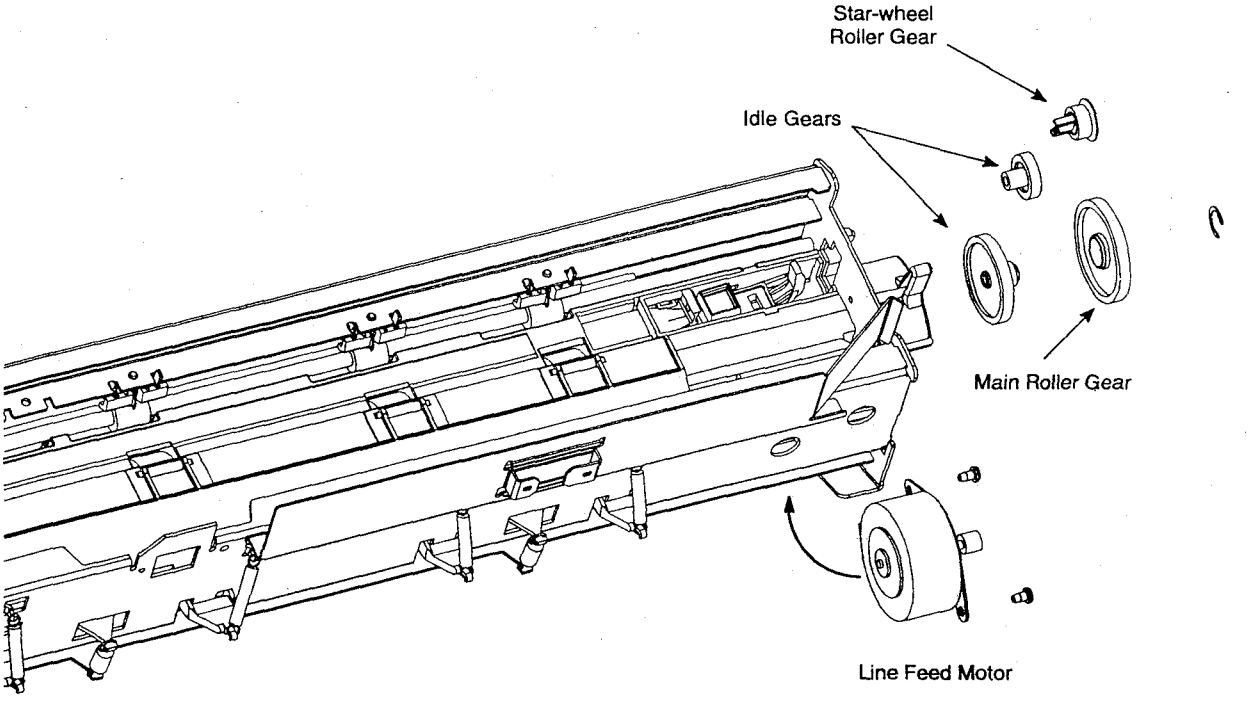

Fig. 4.17 – Line Feed Assembly Removal

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4.3.4 Top Paper Guide Removal

(1) Remove the four extension springs (connecting the top paper guide to the front frame).

(2) Lift up on the rear of the top paper guide, and pull it out of the frame.

NOTE: Leave the top pinch rollers in the guide.

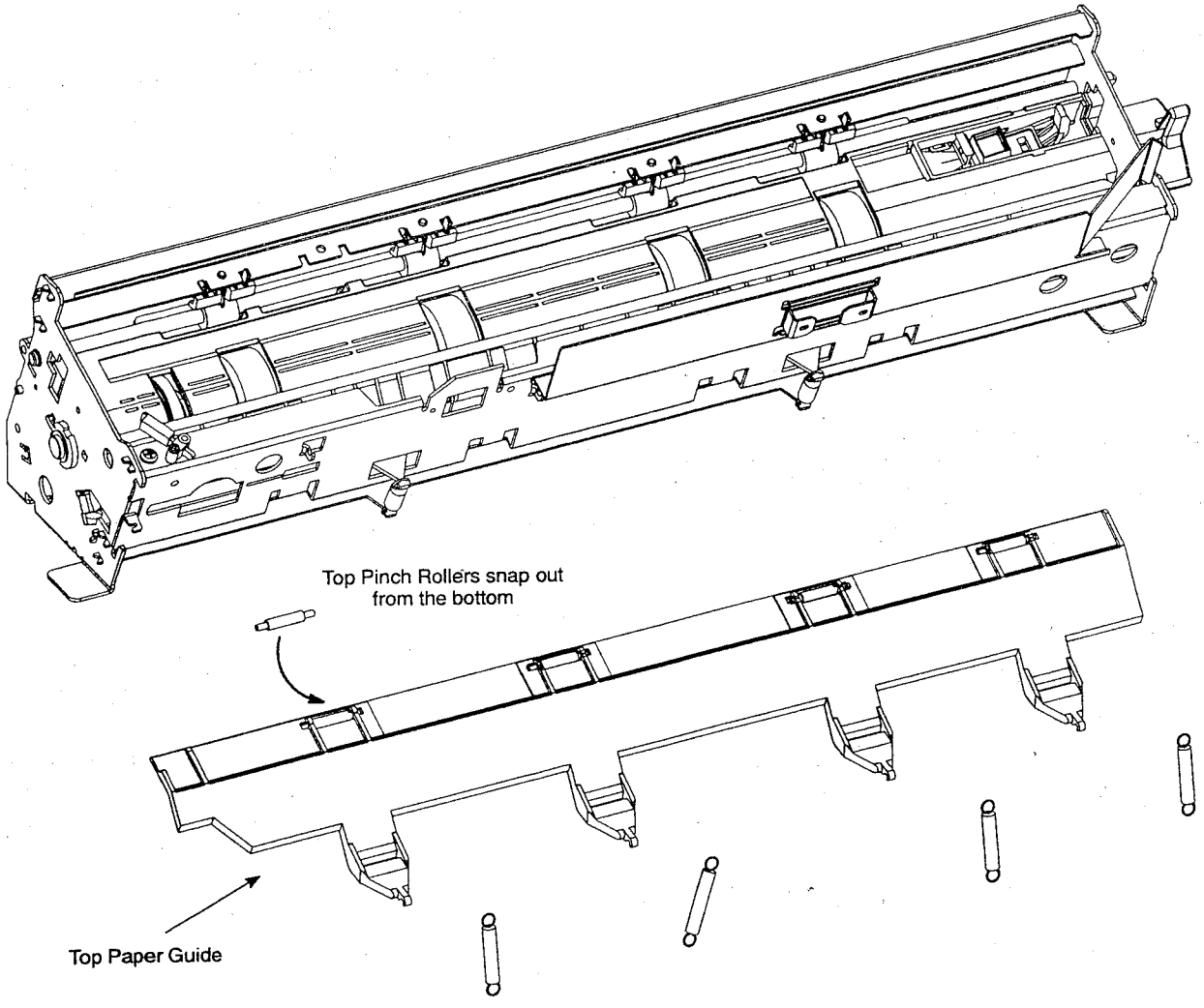


Fig. 4.18 – Top Paper Guide Removal

4.3.5 Star-Wheel Assembly Removal

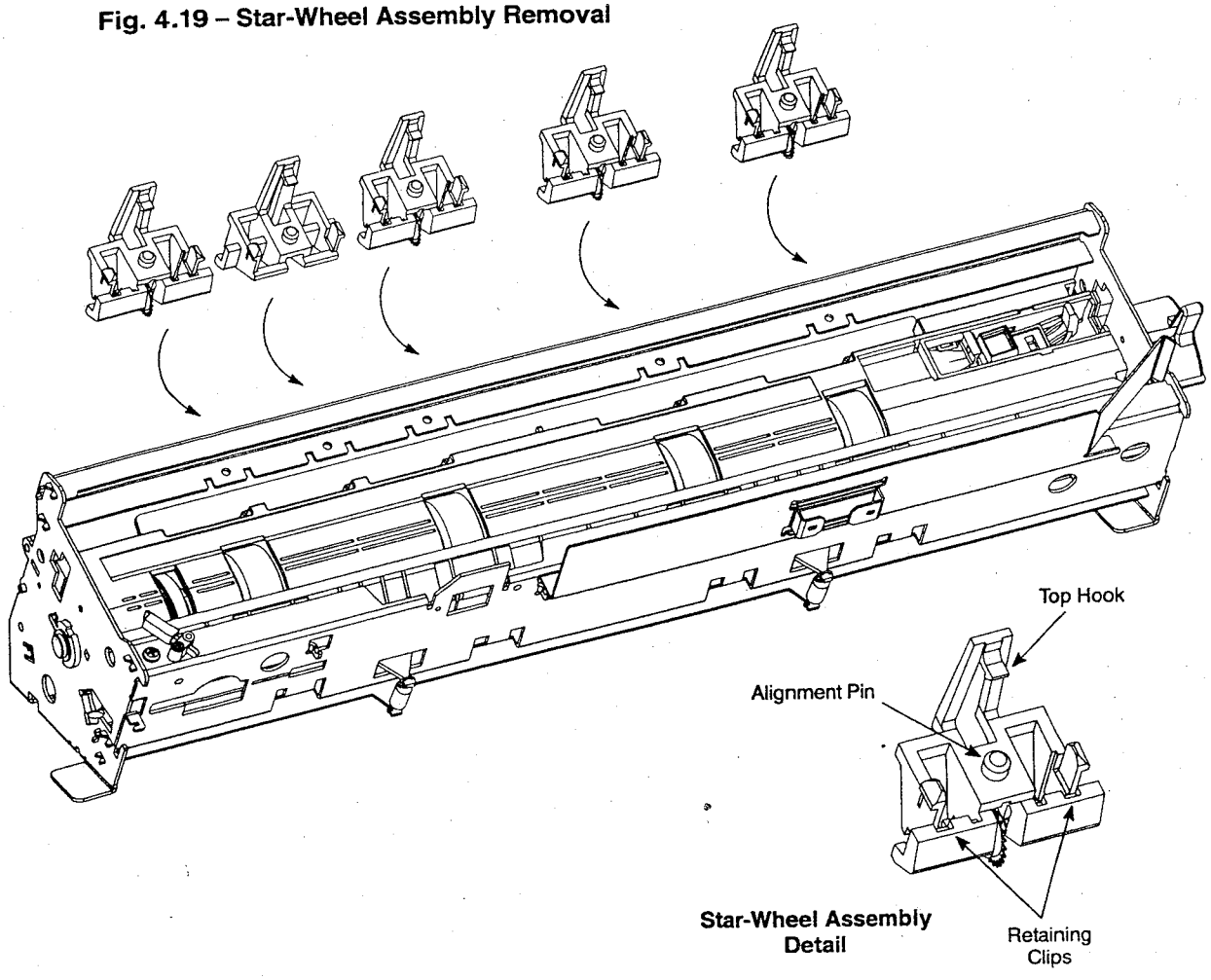
(1) At any star-wheel assembly, disengage the assembly top hook from the carriage rail.

(2) On the inside of the rear printer frame (carriage rail), push the two star-wheel assembly retaining clips inward (toward each other) to clear the notches in the rail.

(3) While squeezing the retaining clips together, push the assembly down and then to the rear of the frame, to clear the alignment pin from the hole in the rail, and remove the assembly from the frame.

(4) Repeat steps (1) through (3) for the other assemblies.

Fig. 4.19 – Star-Wheel Assembly Removal



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4.3.6 Star-Wheel Exit Roller Assembly Removal

Remove the two E-rings from the star-wheel roller shaft, push the shaft to the left (to just clear the right end of the printer frame), and pull the assembly out from inside the frame.

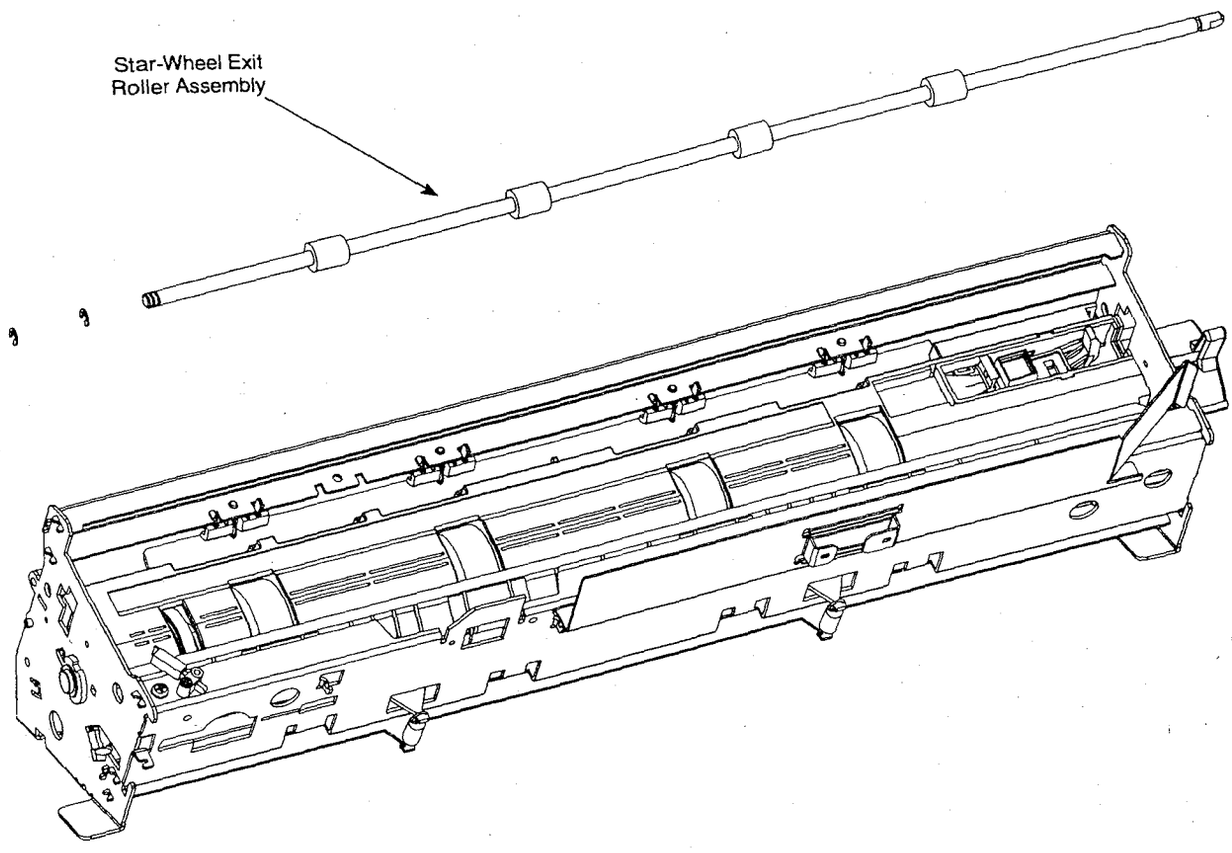

Fig. 4.20 – Star-Wheel Exit Roller Assembly Removal

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4.3.7 Paper Separator Removal

From the rear of the printer mechanism, grasp the paper separator near the left end, carefully deflect it downward until the retaining pin clears the hole in the frame, and pull it out of the frame.

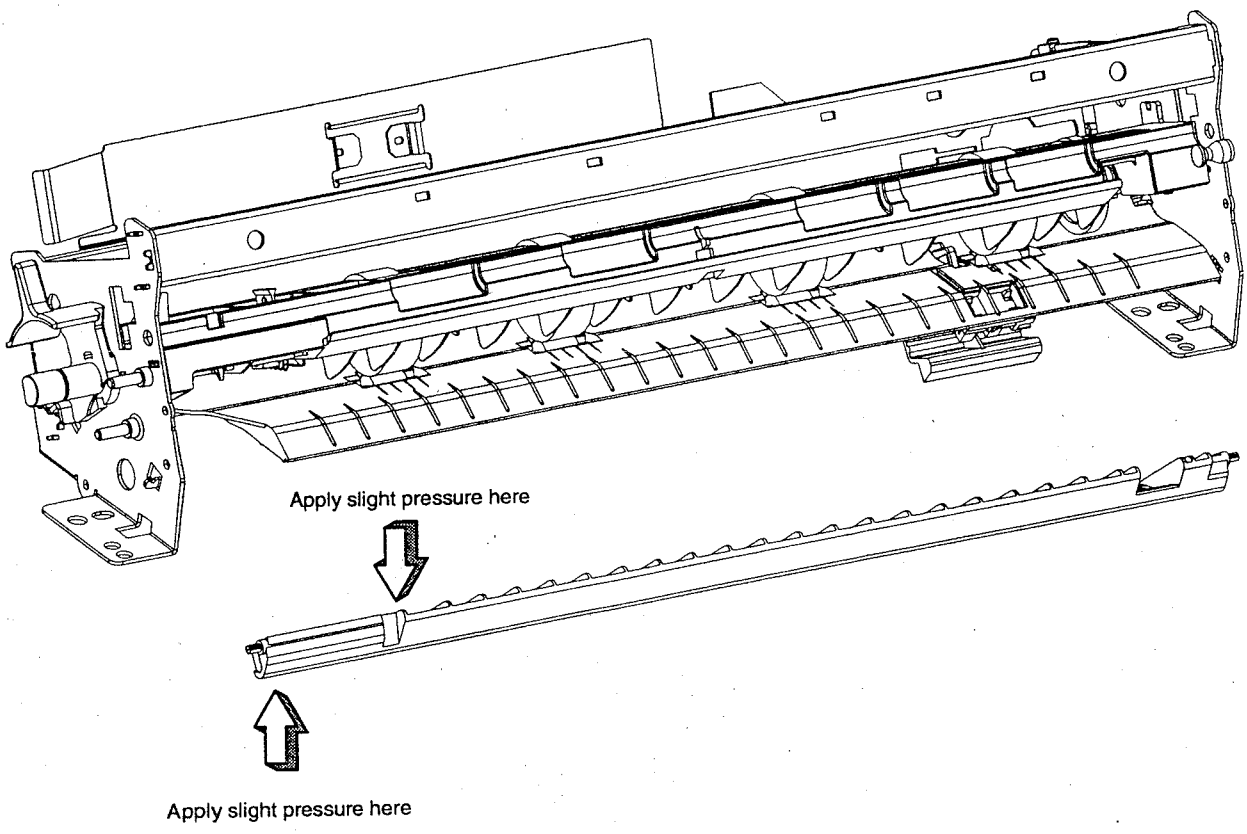

Fig. 4.21 – Paper Separator Removal

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4.3.8 Paper Adjustment Lever Removal

(1) Apply and hold pressure to the pressure plate to release tension on the paper adjustment lever.

(2) Rotate the lever clockwise (about 30°) until it is just past vertical to the base of the printer assembly.

(3) Align the lever with the keyways in the printer right frame, and slide the lever off the main roller shaft.

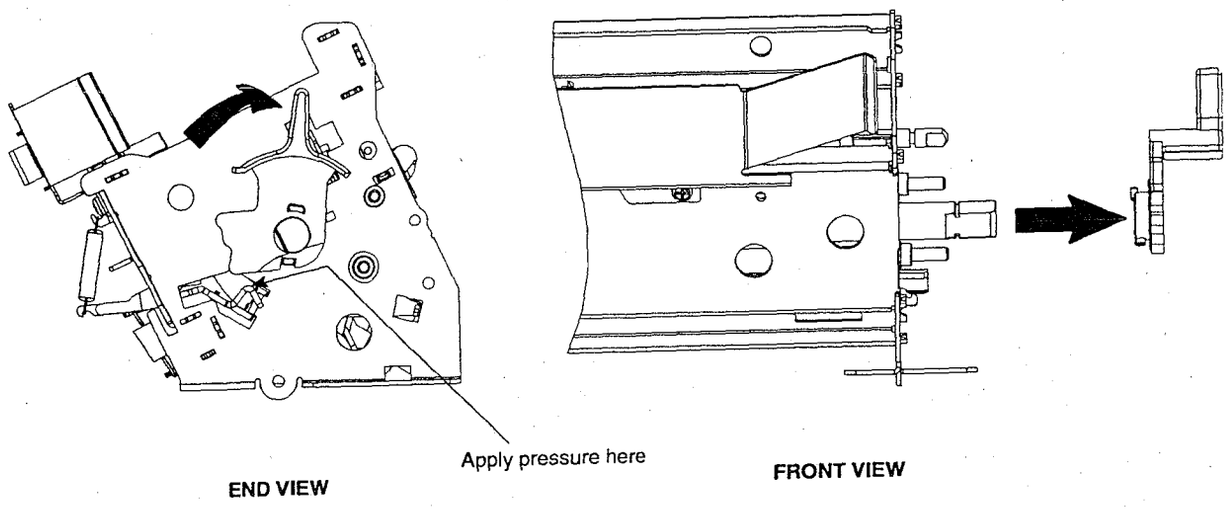

Fig. 4.22 – Paper Adjustment Lever Removal

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4.3.9 Main Paper Guide & Maintenance Station Removal

With the paper adjustment lever removed, rotate the rear of the main paper guide down, lift it up to clear the ribs from the main roller shaft, and remove it from the printer frame.

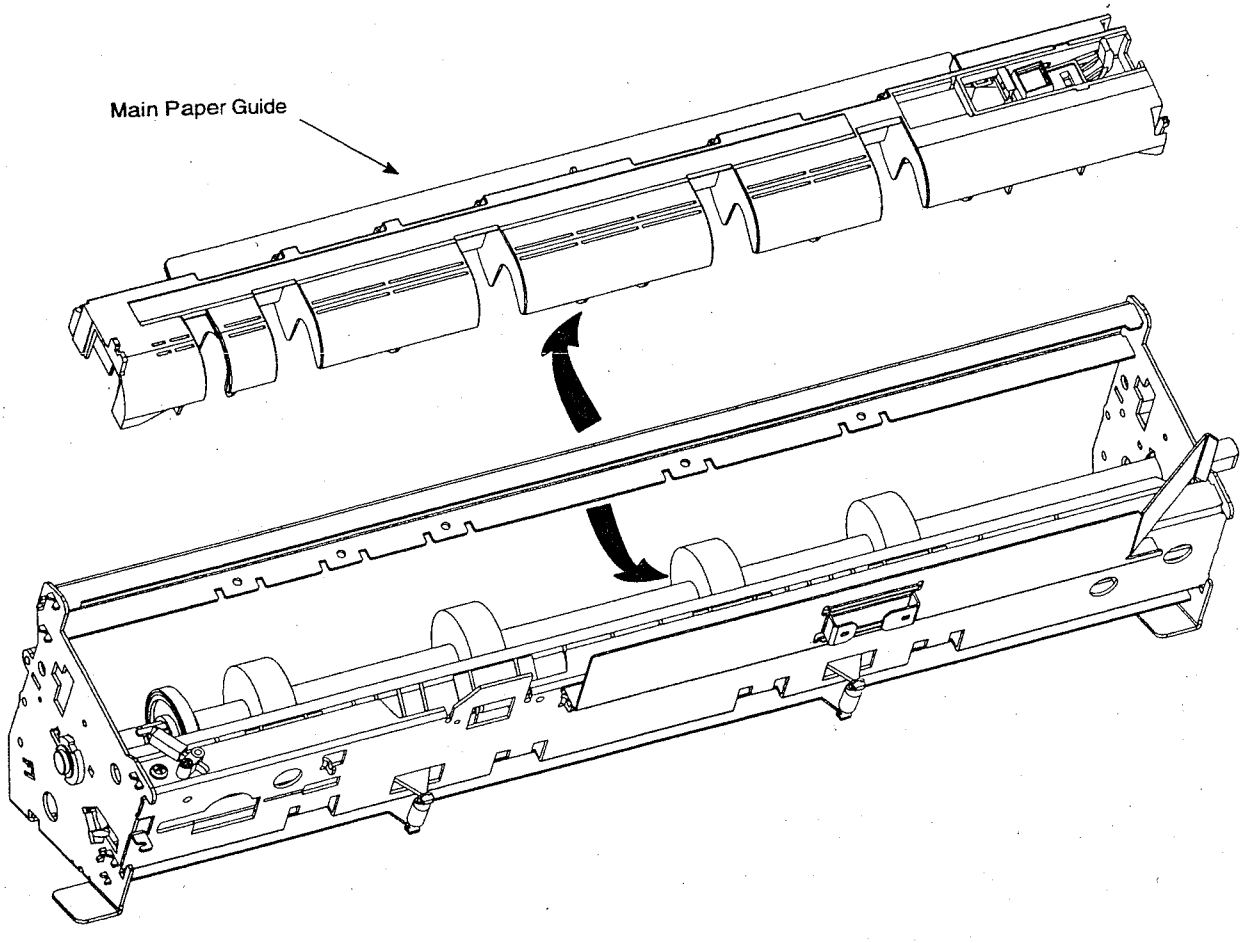

Fig. 4.23 – Main Paper Guide Removal

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4.3.10 Main Roller Assembly Removal

(1) Remove the E-ring from the left end of the main roller shaft.

(2) Slide the main roller assembly to the right until it clears the main roller bearing in the left end of the frame.

(3) Pull the left end of the main roller assembly out to clear the printer frame, and slide the right end out of its hole, and remove the main roller assembly from the frame.

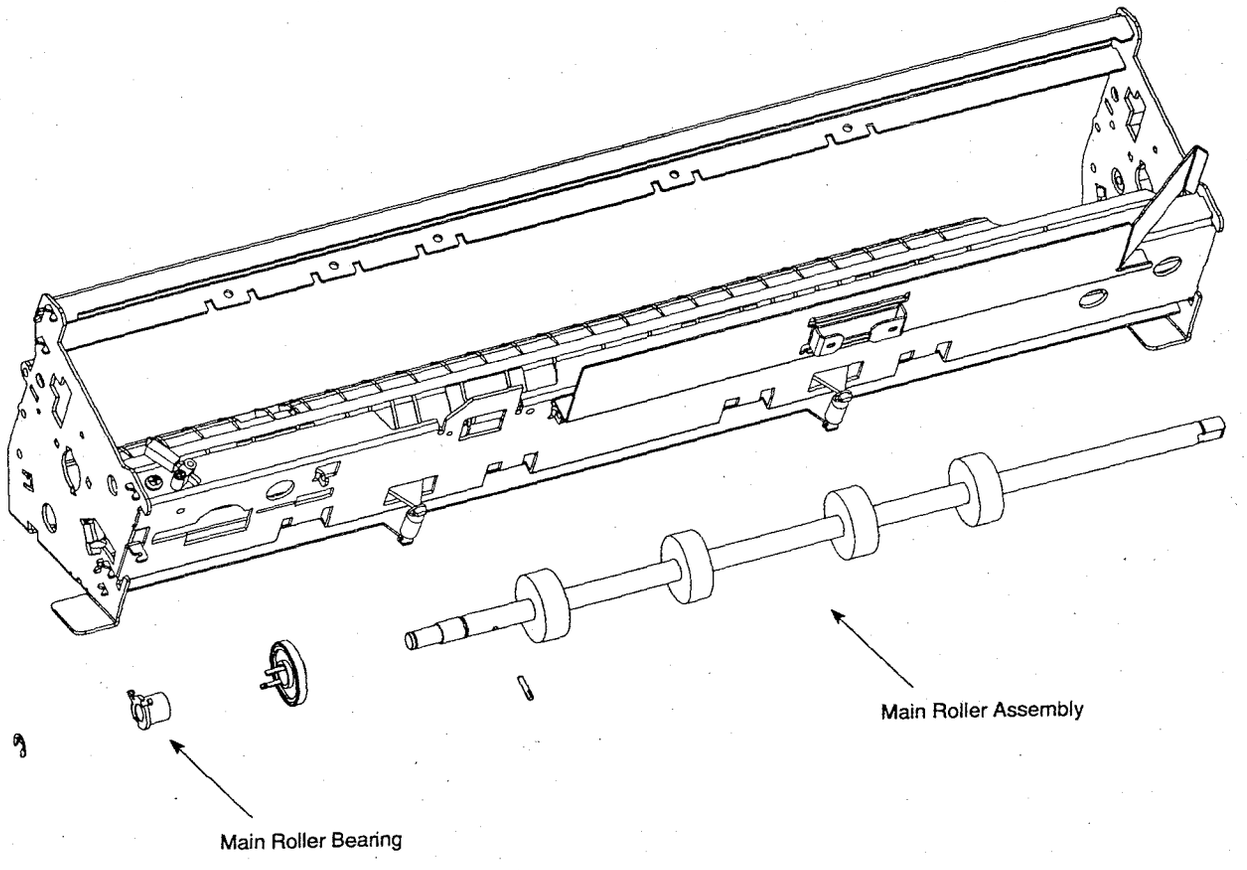

Fig. 4.24 – Main Roller Assembly Removal

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4.3.11 Main Paper Pan Removal

With the main roller assembly removed, pull the main paper pan assembly out of the printer frame.

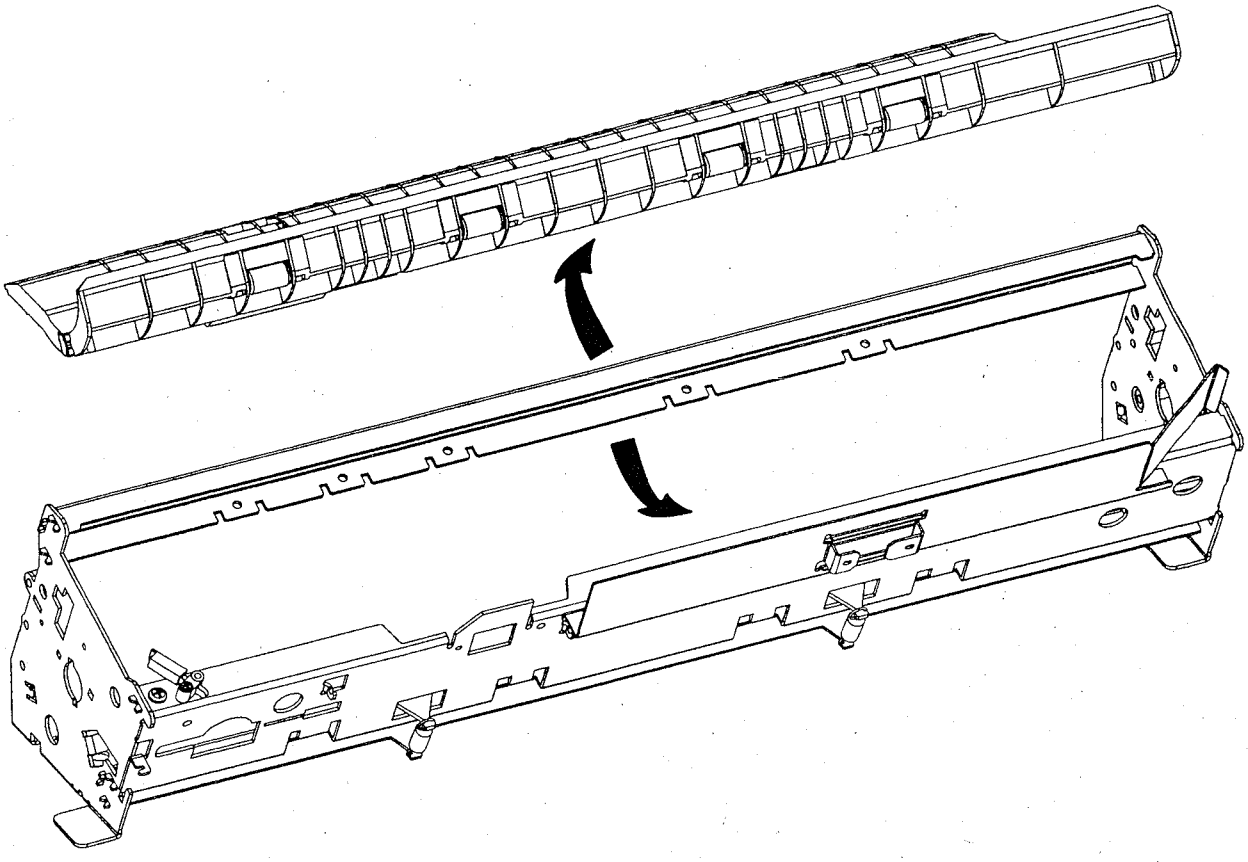

Fig. 4.25 – Main Paper Pan Removal

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4.3.12 Paper Pressure Plate Removal

(1) Remove the two extension springs.

(2) Lift up on the left end of the paper pressure plate to clear the spring hooks from the printer front frame, and pull the right end of the pressure plate from its opening in the printer right frame.

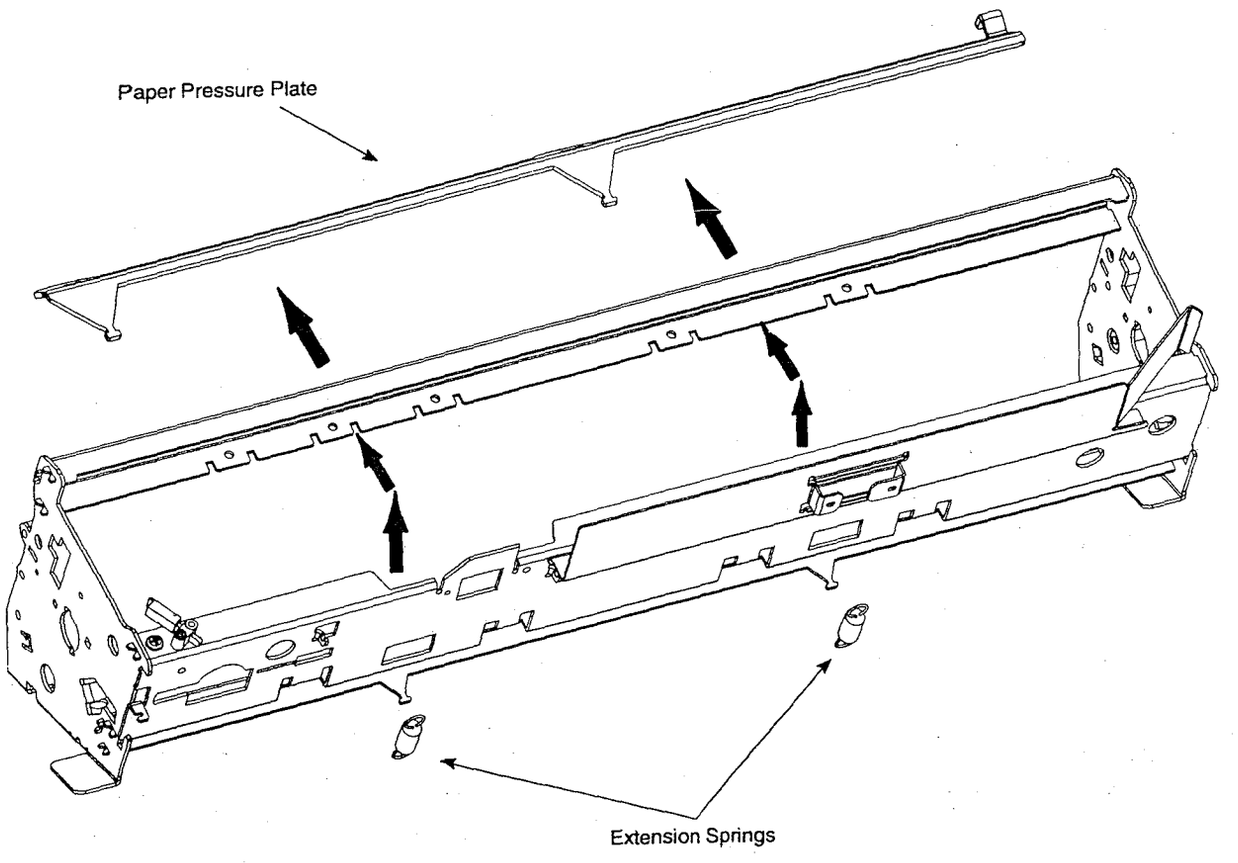

Fig. 4.26 – Paper Pressure Plate Removal

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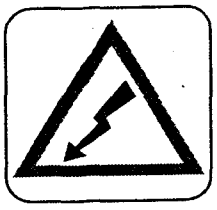
4.4 Printer Adjustments

NOTE: Any time the motor or the belt is removed or replaced, the carriage friction and home position should be checked and adjusted as required. Perform the following adjustments with an ink cartridge installed.

CAUTION: Electro-Static Discharge Hazard



Wear an anti-static wrist strap with ground wire to prevent damage to sensitive electronic components.

4.4.1 Carriage Home Position Adjustment

(1) Remove all covers and remove the printer mechanism.

(2) Install a wiring harness to connect the carriage motor and the home position switch to the main PCB.

CAUTION:

If an extra harness is not available, you may simply remove the two screws securing the printer assembly to the bottom cover and raise the mechanism to access the carriage motor screw; however, you MUST place a non-conductive material (such as paper) between the printer and other electrical components – especially the power supply PCB – to avoid grounding damage to the equipment.

(3) Loosen the CA motor screw.

(4) Turn on all power and from the Main Menu press CODE + SHIFT + BACKSPACE, then select "B" from the Self-Test menu to start the CR (Carriage Reset) Test.

(5) Move the carriage (manually) to the left end.

(6) While holding the carriage at the left end, press the UP arrow key to turn the motor on, and verify that the motor is in phase AB (from display).

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(7) Slowly rotate the motor to the point of *least* vibration (motor noise), hold the motor at this position, and retighten the screw.

(8) Check the carriage motor "jumping" phase:

a) With the CR test still active, press the UP arrow key to turn the motor on.

b) Step the motor left with the left arrow key until the carriage moves to the leftmost position and then "jumps" (moves) back to the right one step.

c) Verify that the motor phase at the "jumping" point is "CD," "D," or "DA" only.

d) If the motor phase is not correct, repeat steps (3) through (7) above, and repeat this step (8) to verify that the motor "jumping" phase is still correct.

e) Press RETURN or CANCEL to end the Self Test, turn OFF the machine, and reinstall the printer and all covers.

4.4.2 Belt Tension Adjustment

Belt tension is maintained by idle pulley bracket spring. The spring is preset to hold the idle pulley in position to maintain the proper tension on the drive belt. If the carriage does not moves freely, or if the belt is removed or replaced, the tension should be checked and adjusted as follows:

(1) With power disconnected from the machine, move the carriage to the right end (maintenance station side) and verify that the belt is properly installed.

(2) Push the idle pulley bracket to verify that it moves freely (if binding, there is too much friction between the bracket and the printer frame).

(3) Line up the carriage with the first star-wheel holder from the right side of the printer assembly (maintenance station side), and attach a friction meter attached above the bearing portion of the carriage.

(4) With the friction meter, pull the carriage to the left to the last star-wheel assembly and verify that the carriage moves freely with a friction reading of 0.3 – 0.7kg force.

(5) If the carriage friction is not correct, loosen the idle pulley bracket screw, move the bracket as necessary to change tension on the spring, and retighten the screw.

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(6) Repeat the test with the friction meter to verify that the carriage friction (belt tension) is within the acceptable range.

NOTE: If friction is still not within acceptable limits, lubricate the idle pulley shaft and idle pulley rotation point . See *Lubrication* in Chapter 5, Maintenance, for details.

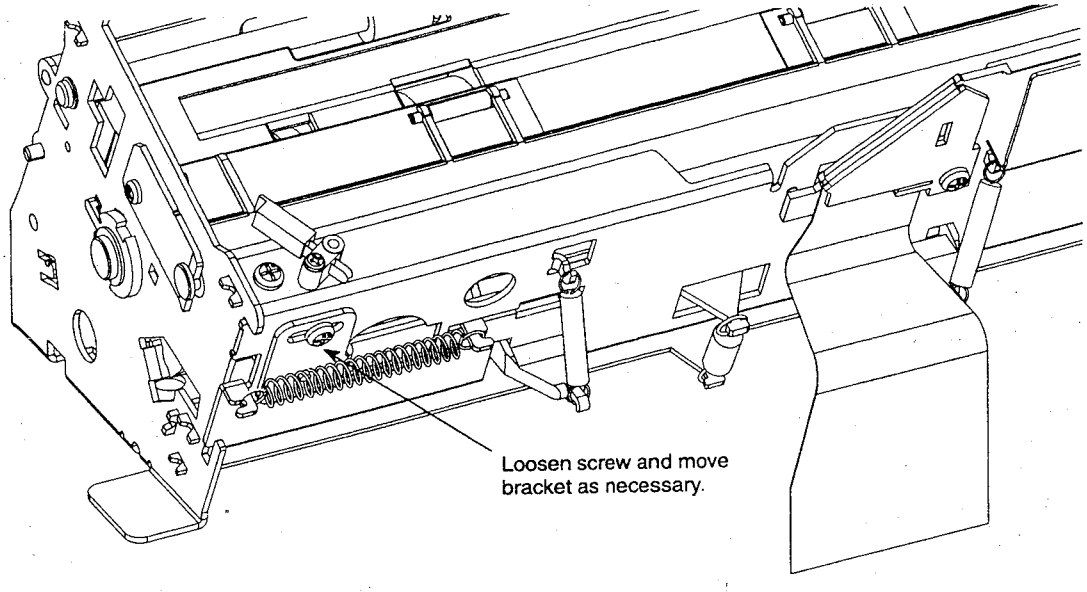

Fig. 4.27 – Belt Tension Adjustment

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5. FDD Assembly Removal

(1) Remove the FDD flat cable from the main PCB.

(2) Unplug the power cable from the FDD.

(3) Remove the two screws securing the FDD to the bottom cover.

(4) Move the FDD to the left to clear the retainers in the bottom cover, and lift it out.

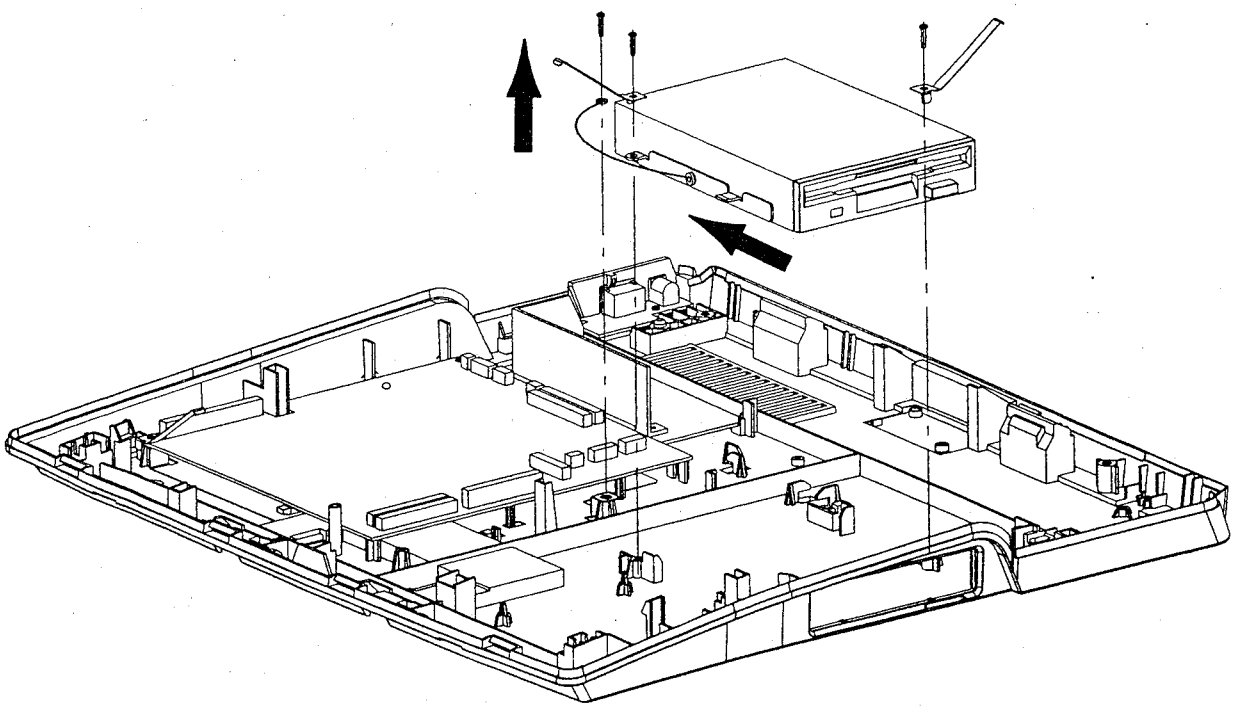

Fig. 4.28 – FDD Assembly Removal

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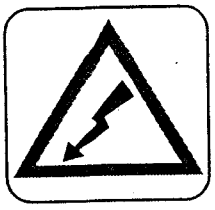
6. Power Supply Assembly

CAUTION: Electro-Static Discharge Hazard
Wear an anti-static wrist strap with ground wire to prevent damage to sensitive electronic components.



As shown in Fig. 4.29, the power supply PCB is mounted on the bottom cover.

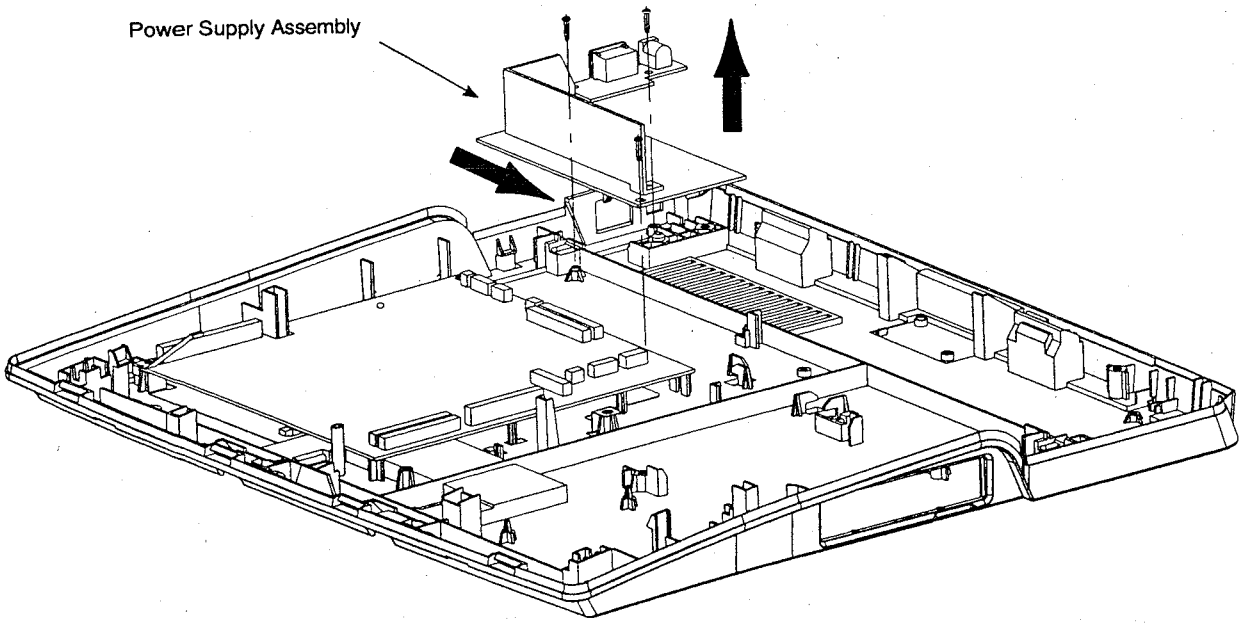


Fig. 4.29 – Power Supply Assembly

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6.1 Power Supply PCB Removal

(1) Disconnect the ground harness (FG) from the printer assembly, and disconnect CN1 from the main PCB.

(2) Remove the two screws securing the PS PCB section (containing the heat sink) to the bottom cover, slide the section to the left to clear the retaining tab, and lift it out.

(3) Remove the screw securing the PS PCB switch section, slide it to the right and up to clear the switch housing, and lift it out.

6.2 Power Supply PCB Installation

(1) Place the PS PCB section containing the heat sink in the bottom cover, slide it to the right to insert the edge under the retaining tab, and replace the two screws.

(2) Place the PS PCB switch section into its location in the bottom cover, slide it to the left and down to insert the switch in its housing, and replace the third screw.

(3) Reconnect the ground harness (FG) to the printer assembly, and CN1 to the main PCB.

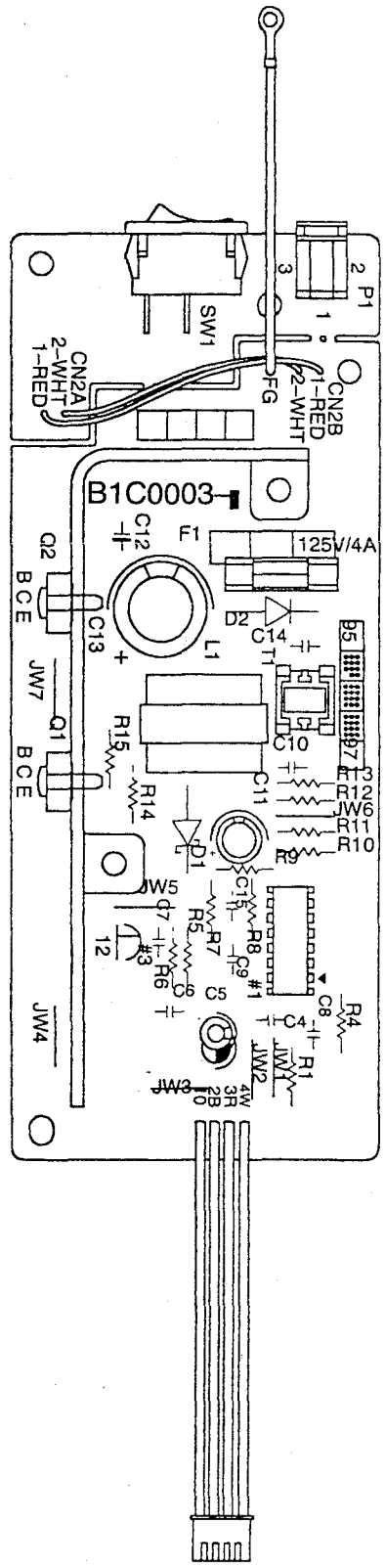

Fig. 4.30 – Power Supply PCB

7. AC Adaptor Disassembly

WARNING: Low Voltage Shock Hazard exists. Before attempting to disassemble the AC adaptor, ground the output connector (through a 1K ohm resistor) to discharge any voltage remaining in the unit.

The only serviceable item of the AC adaptor is the fuse. To replace the fuse:

(1) Unplug the adaptor from the power source.

(2) Remove the four screws from the bottom cover.

(3) Remove the top cover.

(4) Remove the adaptor PCB from the bottom cover.

(5) Replace the fuse in the adaptor with a same-rated fuse.

(6) Reassemble the adaptor.

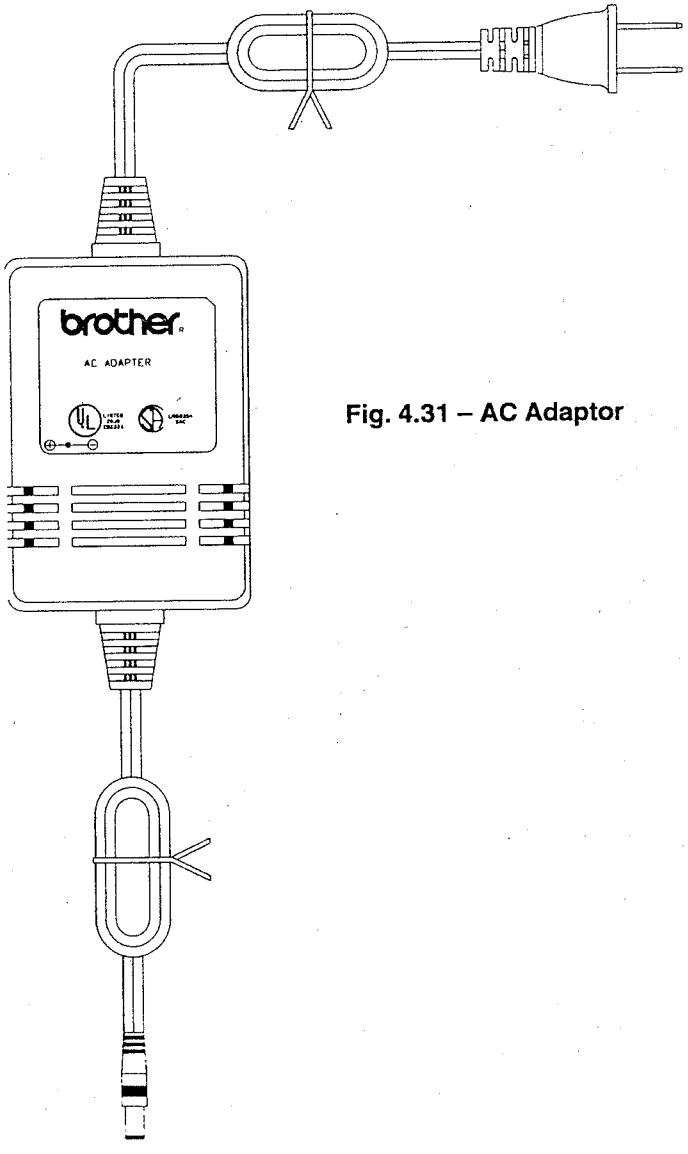

Fig. 4.31 – AC Adaptor

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8. Main PCB Removal

CAUTION: Electro-Static Discharge Hazard

Wear an anti-static wrist strap with ground wire to prevent damage to sensitive electronic components. Be sure to hold the connector – *not* the cable – when connecting or disconnecting a harness.

The main PCB is fitted to the bottom cover and secured by screws. Remove the screws and all connectors and cables from the main PCB, and lift it out of the bottom cover.

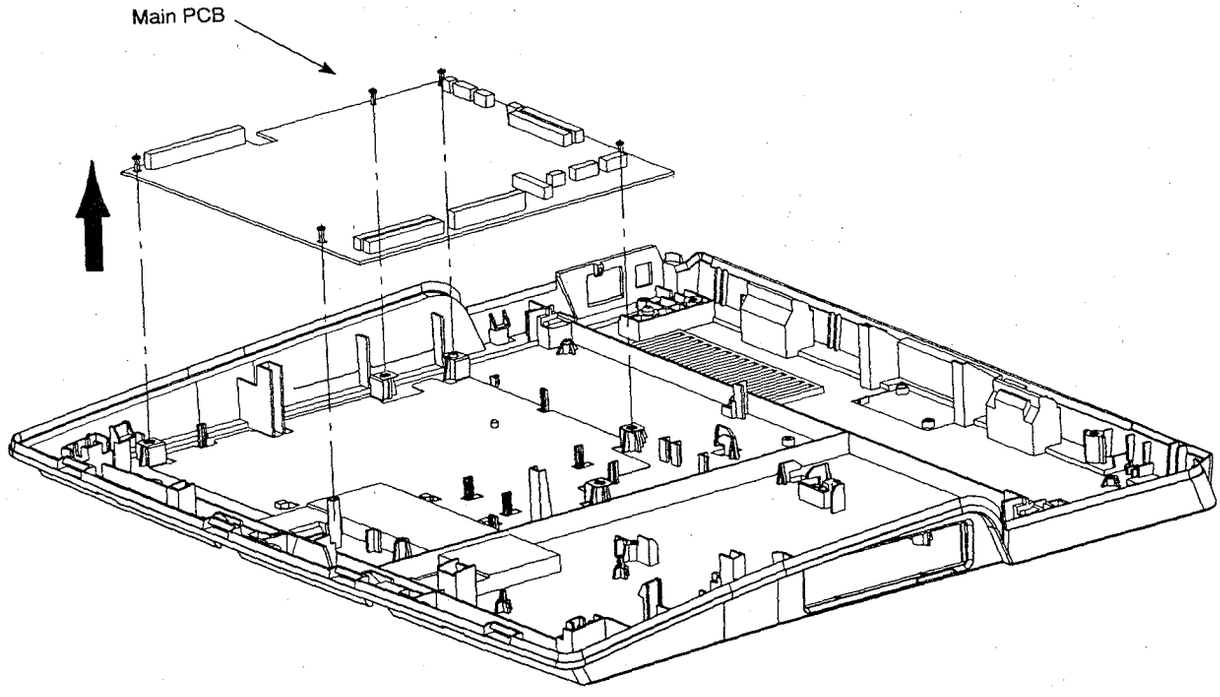

Fig. 4.32 – Main PCB Removal

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9. Shield Plate (ESD) Removal

Lift up on the rear side of the shield plate to clear the alignment pin, slide the shield plate forward to clear the three retaining clips in the bottom cover, and lift it out.

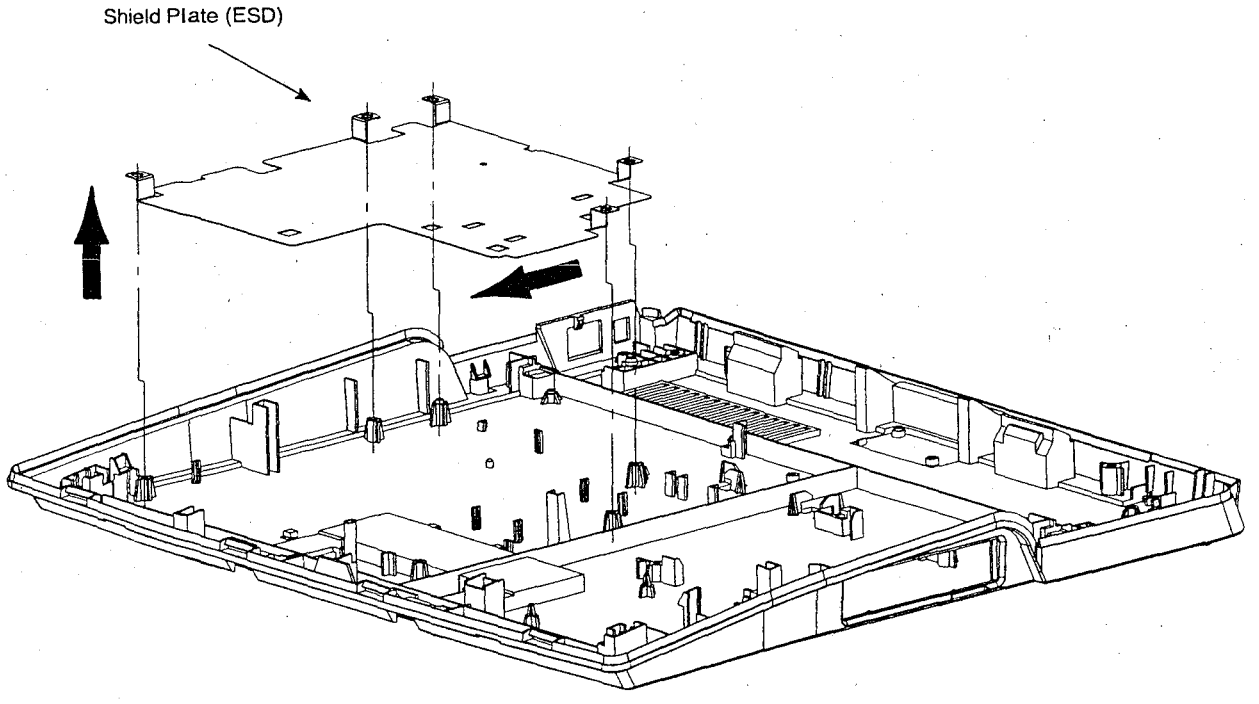

Fig. 4.33 – Shield Plate (ESD) Removal

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10. Auto Cut-Sheet Feeder (ACF) Disassembly

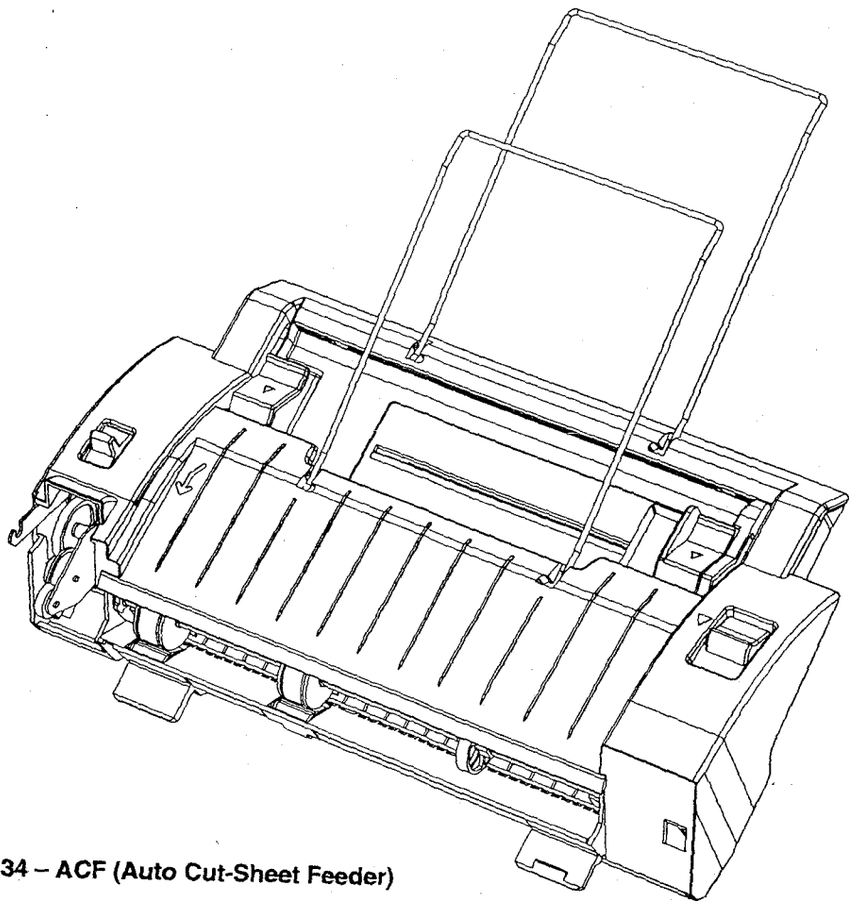

Fig. 4.34 – ACF (Auto Cut-Sheet Feeder)

To disassemble the ACF:

(1) Remove the two paper support wires.

(2) Remove the front tray:

a) On the back of the ACF, remove the screw from the bottom tray.

b) At the bottom corners of the bottom tray, pry open the two retaining tabs holding the front tray to the bottom tray.

c) Pull up on the front tray to release the other four retaining tabs, and lift the front tray off the ACF.

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(3) Remove the gear holder assembly:

a) Disengage the gear holder assembly extension spring from its hook on the bottom tray.

b) Remove the two screws securing the gear holder assembly to the bottom tray.

c) Lift up and out on the entire gear holder assembly to separate it from the ACF.

(4) Remove the main shaft assembly:

a) Remove the main CF gear from the main shaft.

b) Remove the two E-rings from the left main shaft bearing (gear side).

c) Remove the main shaft bearing by prying the bearing leg out of the hole in the bottom tray and rotating the bearing 90° up.

d) Slide the main shaft to the left until the right end clears the hole in the bottom tray, and lift the main shaft out of the bottom tray.

(5) Disassemble the main shaft:

a) Remove the other six E-rings from the main shaft assembly.

b) Slide all rollers off the main shaft:
idle roller, roller flanges (2 ea. main roller), two main rollers (rollers & cores).

(6) Pull the hopper release lever (to release the retaining tab on the back of the hopper from the slot in the bottom tray), and pull the hopper up and out of the bottom tray.

(7) Pull the hopper release lever cap up and out of its holder (some resistance will be felt).

(8) Unhook the lock lever spring from the bottom tray, and slide the lock lever off the retaining post and out of the bottom tray.

(9) Remove the two hopper springs from the bottom tray.

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(10) Remove the two bottom separators from the left side of the bottom tray:

a) From the underside of the bottom tray, release the two bottom separator latches (press inward on each) for one separator.

b) If necessary, carefully release the retaining pins at the top of each side of the bottom separator from the slots in the bottom tray.

c) Repeat steps (a) and (b) to remove the other separator.

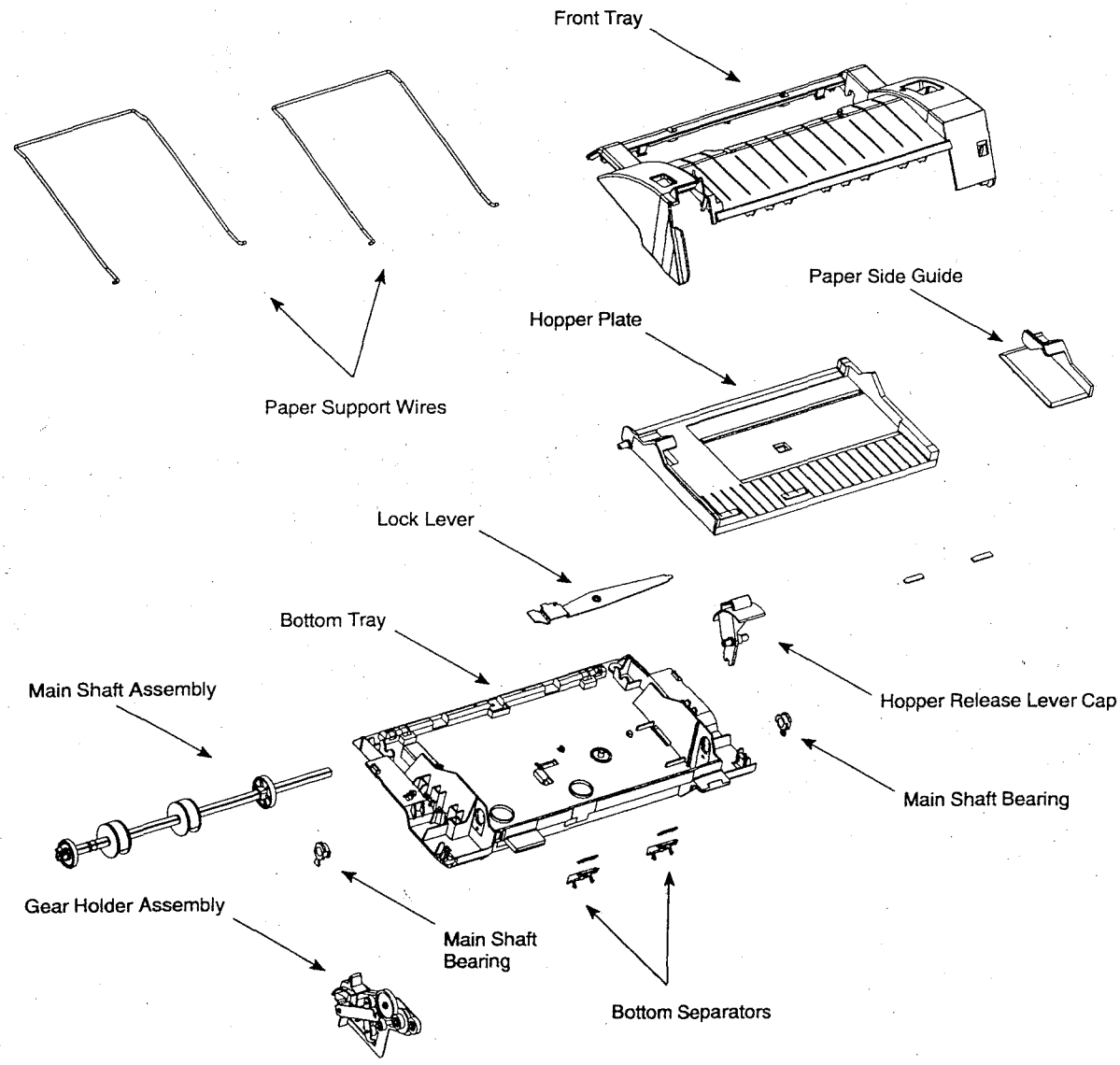

Fig. 4.35 – ACF (Exploded View)

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CHAPTER 5 Maintenance

1. LUBRICATION

1.1 Lubricants

Symbol	Lubricant
E	Epinoc grease #1
S	Silicone grease KS64F
SO	Silicone oil KF96
T	Exxon #32

Table 5.1 – Recommended Lubricants

1.2 Precautions

1. Lubricate carefully so that the oil or grease will not stick to places other than the specified points; otherwise, the plastic parts and electronic boards will be adversely affected.
2. Do not apply an excessive amount of lubricant; otherwise, the lubricant may drip onto places other than the specified lubrication points during use or storage.
3. Make sure to apply a sufficient amount of lubricant to contact parts and sliding surfaces consisting of more than one material.

1.3 Lubrication Points

See the illustrations on the following pages for location and types of lubricant for the following components:

NOTE: Some disassembly of components may be required.

1. Frame Assembly (see Fig. 5.1)
2. Carriage Movement Assembly (see Fig. 5.2)
3. Idle Pulley Assembly (see Fig. 5.3)
4. Star Wheel Roller Assembly (see Fig. 5.4)
5. Main Paper Pan & Pinch Roller Assembly (see Fig. 5.5)
6. Paper Pressure Plate (see Fig. 5.6)

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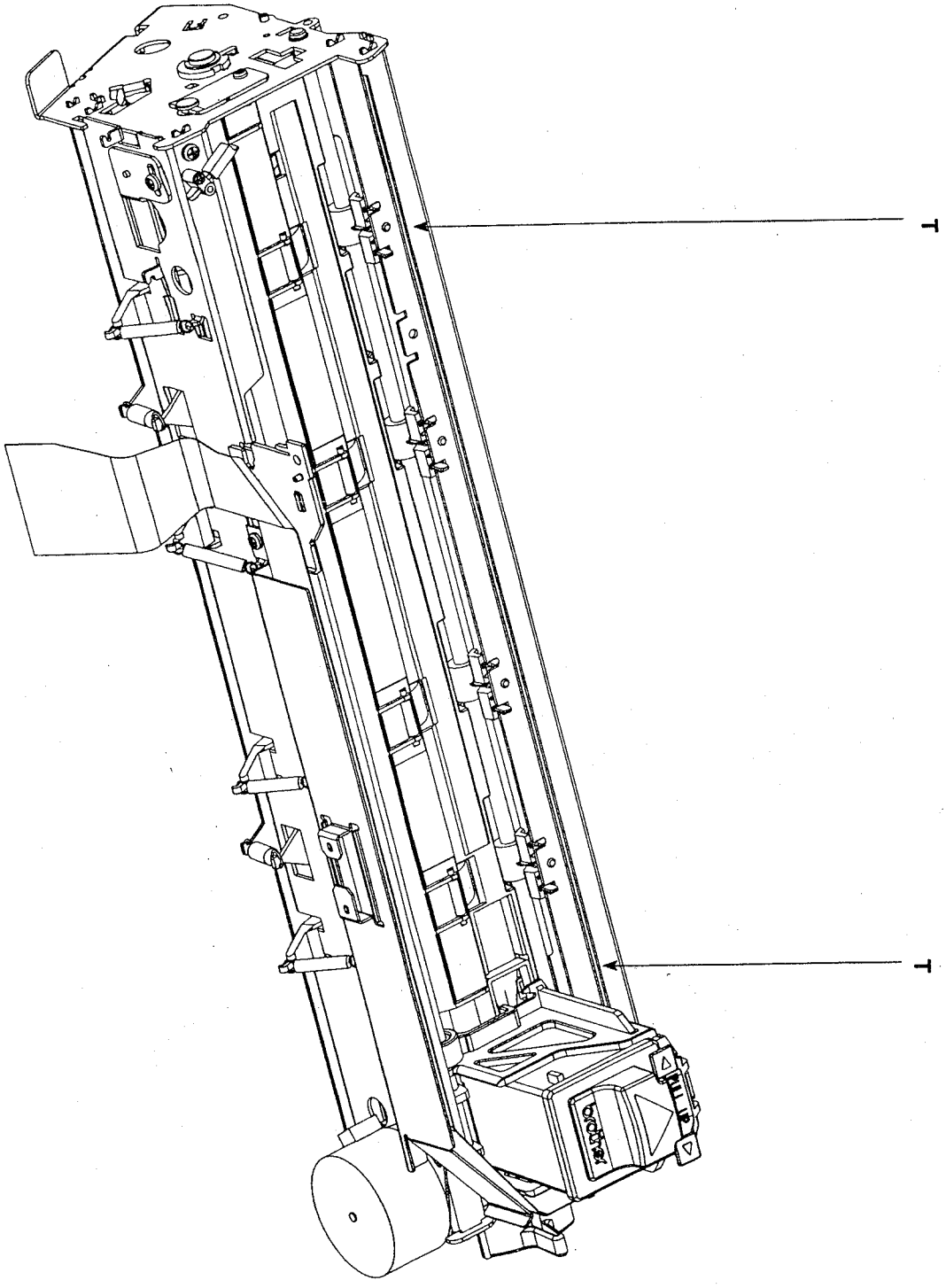

Fig. 5.1 – Frame Assembly Lubrication Points

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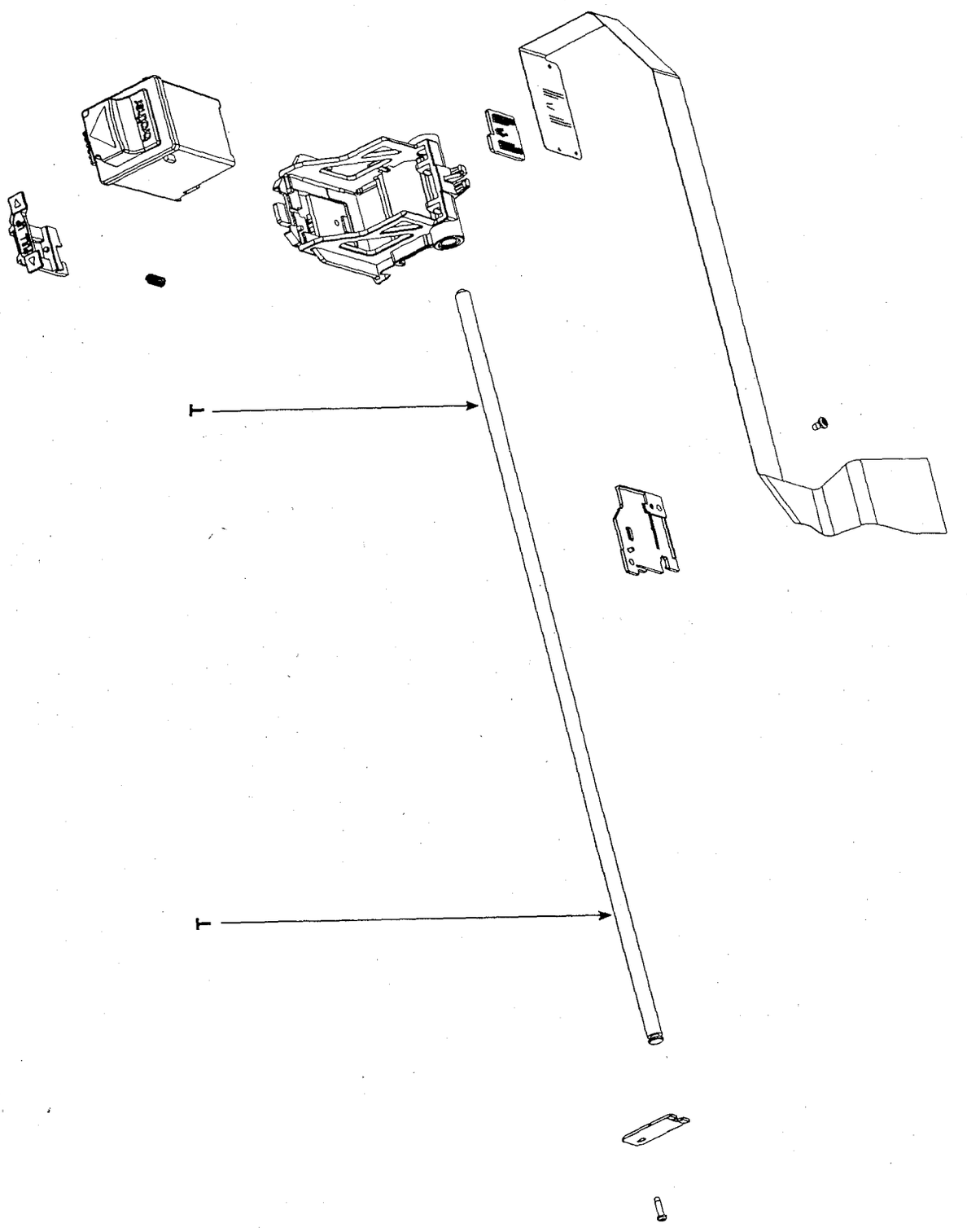

Fig. 5.2 – Carriage Movement Lubrication Points

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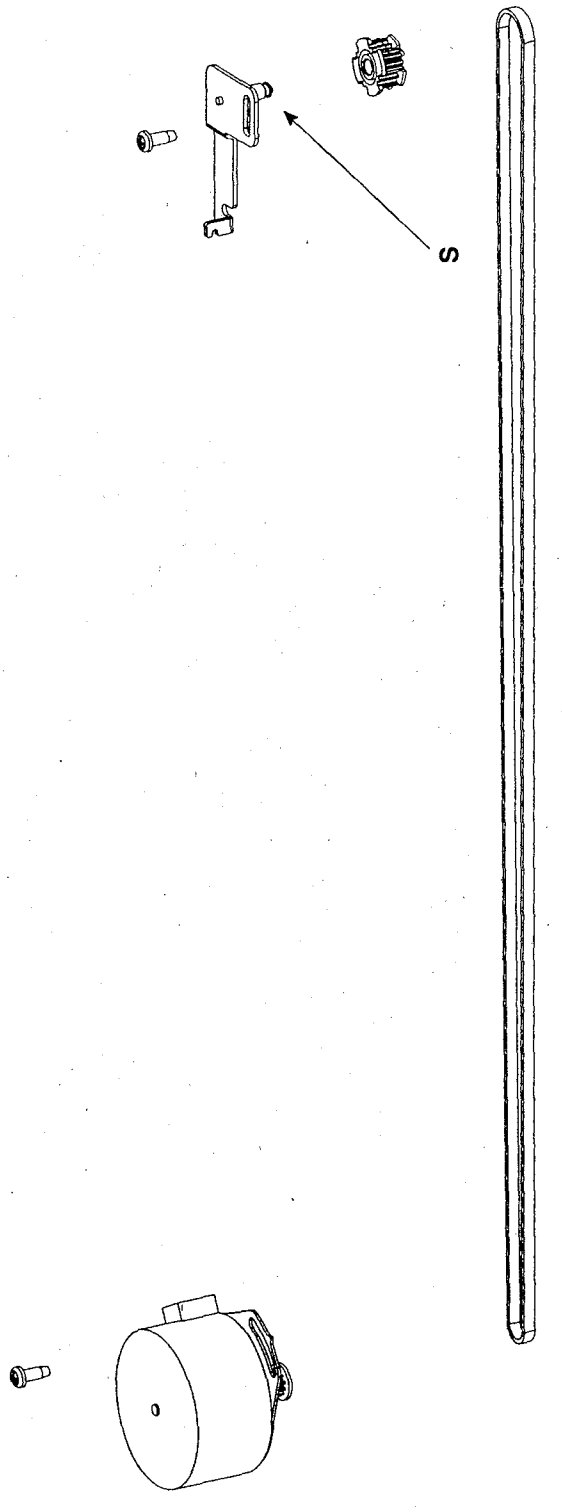

Fig. 5.3 – Idle Pulley Assembly Lubrication Points

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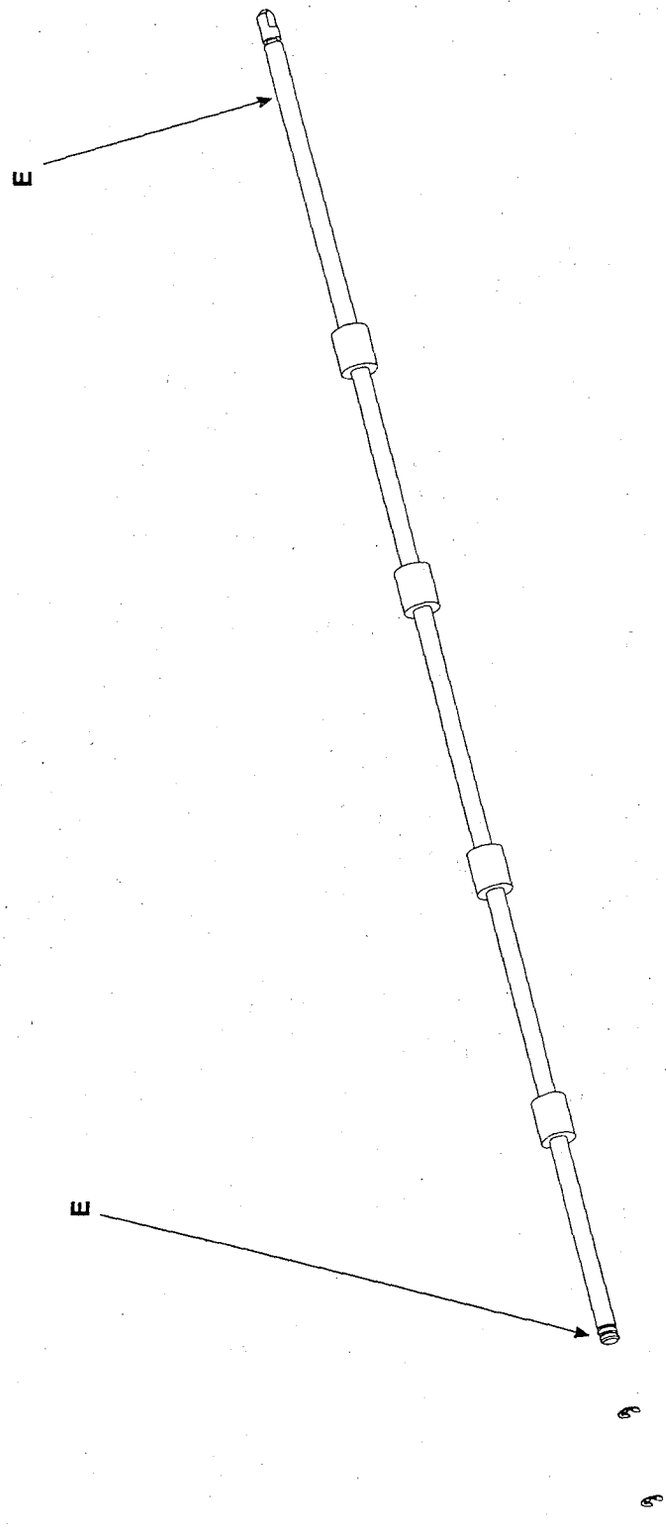

Fig. 5.4 – Star Wheel Roller Assembly Lubrication Points

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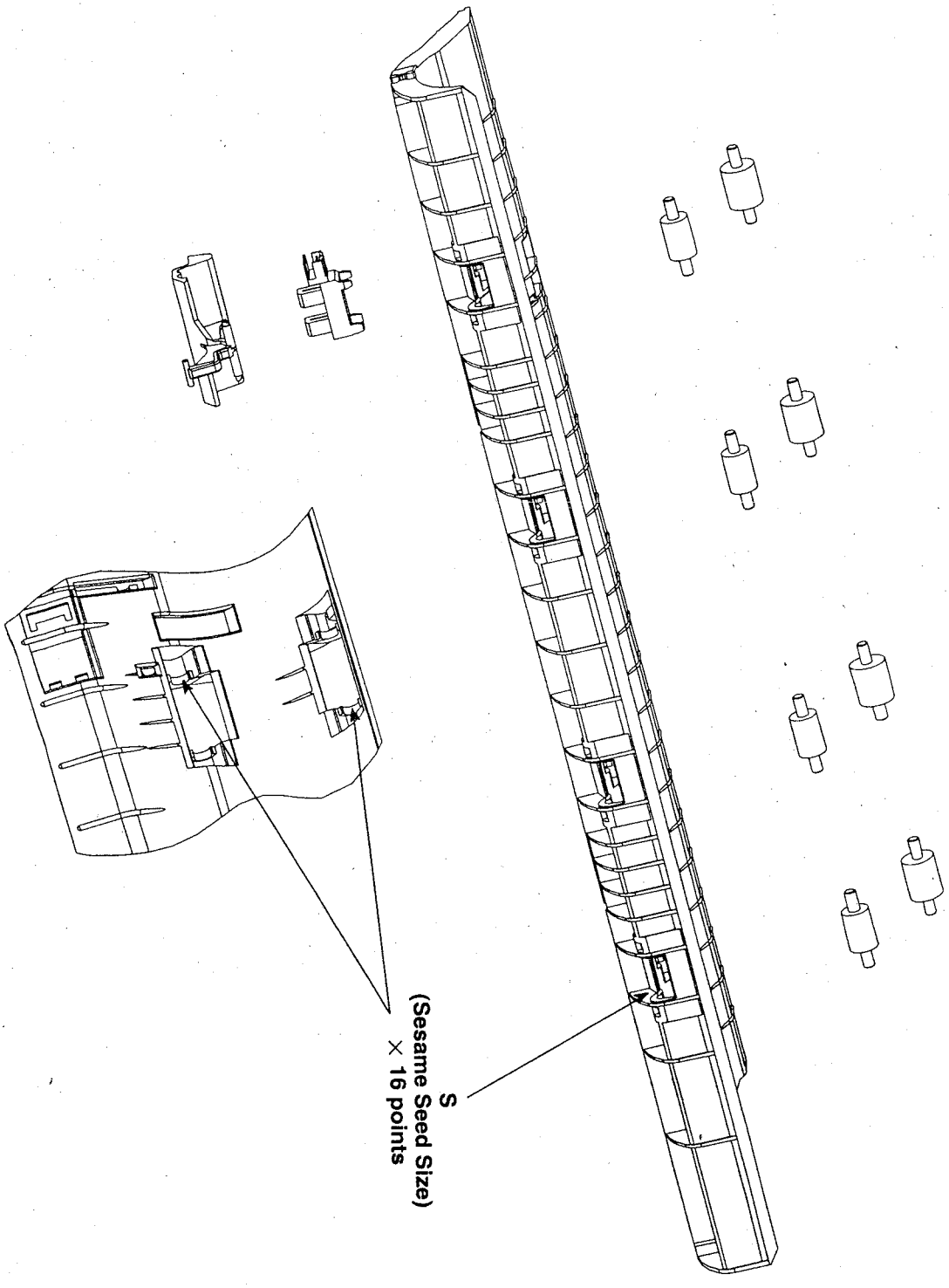

Fig. 5.5 – Main Paper Pan & Pinch Roller Assembly Lubrication Points

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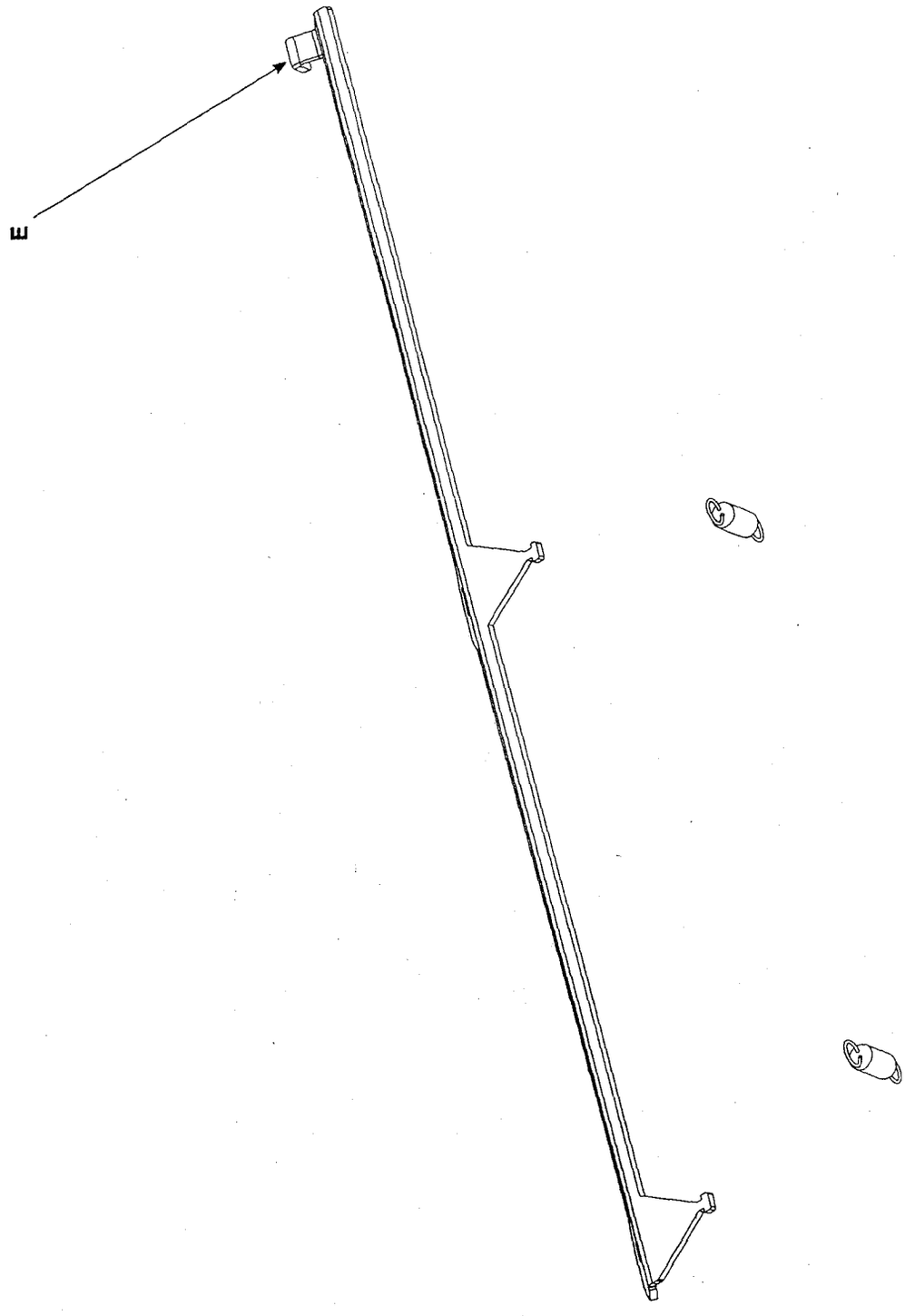

Fig. 5.6 – Paper Pressure Plate Assembly Lubrication

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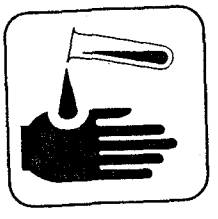
2. REPLACING THE INK CARTRIDGE

WARNING: The bottom of the ink-jet cartridge is covered with wet ink. Avoid contact of ink with skin and clothing. Ink may cause irritation – especially to the eyes.

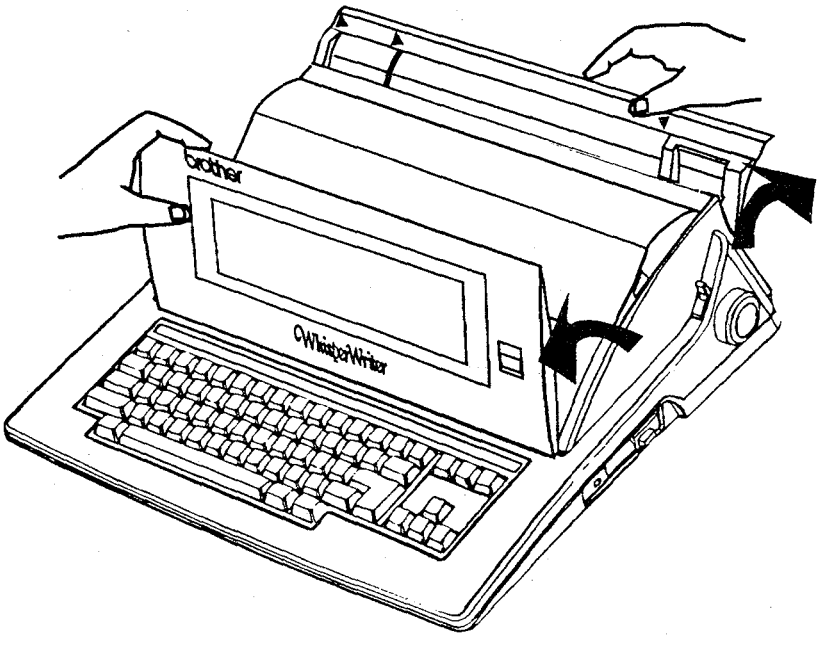


The Whisperwriter uses a replaceable ink-jet cartridge that contains both the print head and ink. It should be replaced after about 1,000,000 characters (estimated using normal text, 12 point, Brougham font).

(1) Press **CODE + INK CHG**. *The carriage will move to the ink change (home) position.* **Do not move the carriage manually from side to side.** *The following screen message will appear:*

Change the ink cartridge?
After changing the ink cartridge, press RETURN to clean head.

(2) Open the paper support and tilt the LCD forward.



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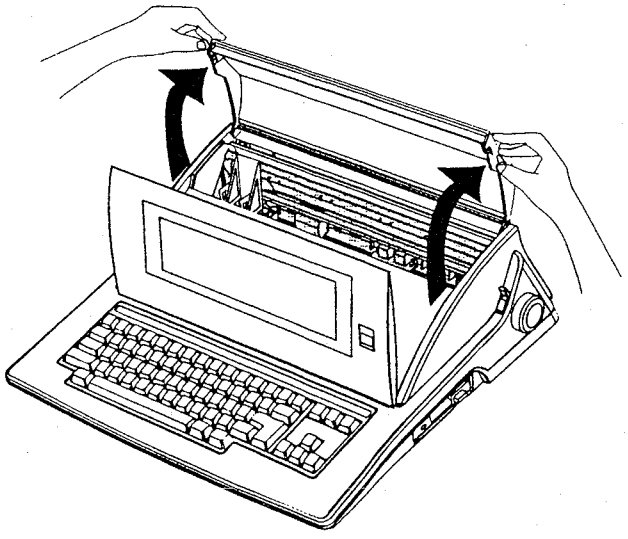
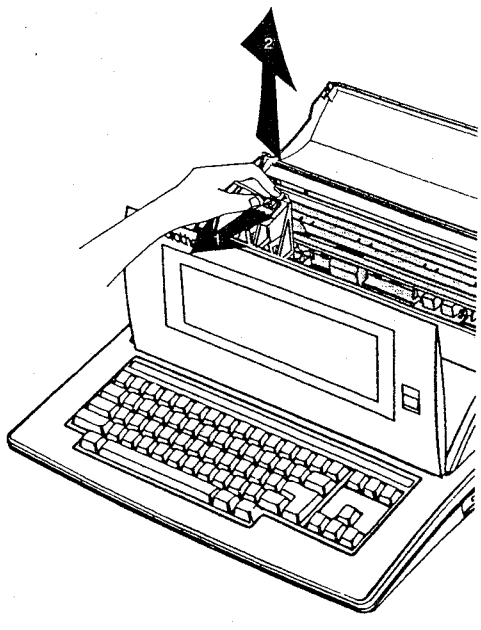
(3) Open the top cover.



(4) Grasp the ink-jet cartridge as shown below and pull it towards you (until you hear the release "click"); then pull the cartridge straight up and out of the carriage.



(5) Remove the protection tape from the new ink-jet cartridge (do not shake the cartridge after the tape has been removed).

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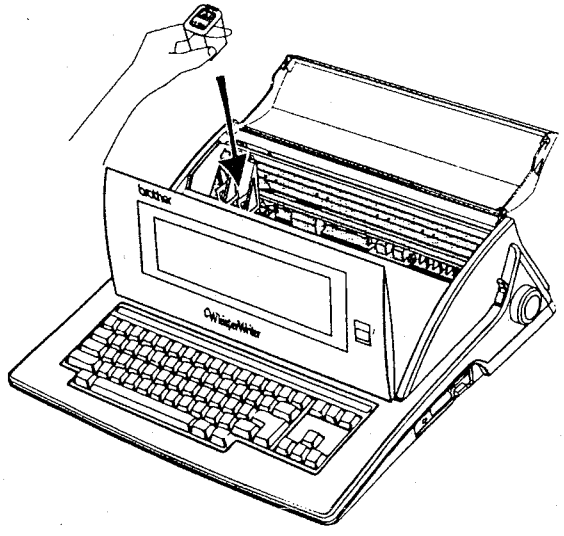
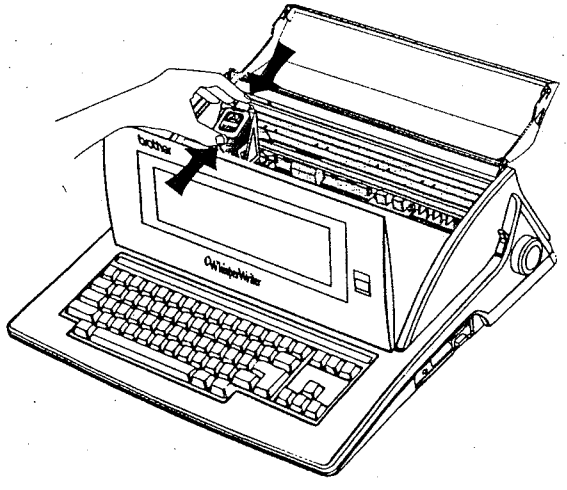
(6) Slide the cartridge into the carriage bracket as shown below.



(7) Squeeze the cartridge bracket and cartridge together until the cartridge snaps under the latch on the bracket.



(8) Press **RETURN**. *The ink-jet cartridge is ready to use.*

(9) Close the LCD, paper support, and the top cover.

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3. CLEANING THE PRINTHEAD

WARNING: The bottom of the ink-jet cartridge is covered with wet ink. Avoid contact of ink with skin and clothing. Ink may cause irritation – especially to the eyes.

3.1 Cleaning the Printhead Automatically

If the ink on the page looks splotchy or smeared, or if blank spaces appear in characters, the printhead may be cleaned. To automatically clean the printhead, press **CODE + SHIFT + INK CHG**.

3.2 Cleaning the Ink-Jet Nozzles and Contacts

If print quality does not improve after automatically cleaning the printhead, the problem may be dried ink on the nozzles, contacts, or on the print cartridge bracket contacts.

(1) Remove the ink-jet cartridge.

(2) With a clean, water-dampened cloth, gently wipe the entire copper-colored area, including the nozzles and contacts.

NOTE: To dissolve any dried ink, hold the damp cloth against the nozzles for a few seconds; then gently blot and wipe dry.

(3) Allow the copper-colored area to dry, and re-install the cartridge.

(4) Press RETURN, and then **CODE + SHIFT + INK CHG**, and close the cover.

NOTE: If the Whisperwriter is still not printing properly, clean the bracket contacts in the carriage.

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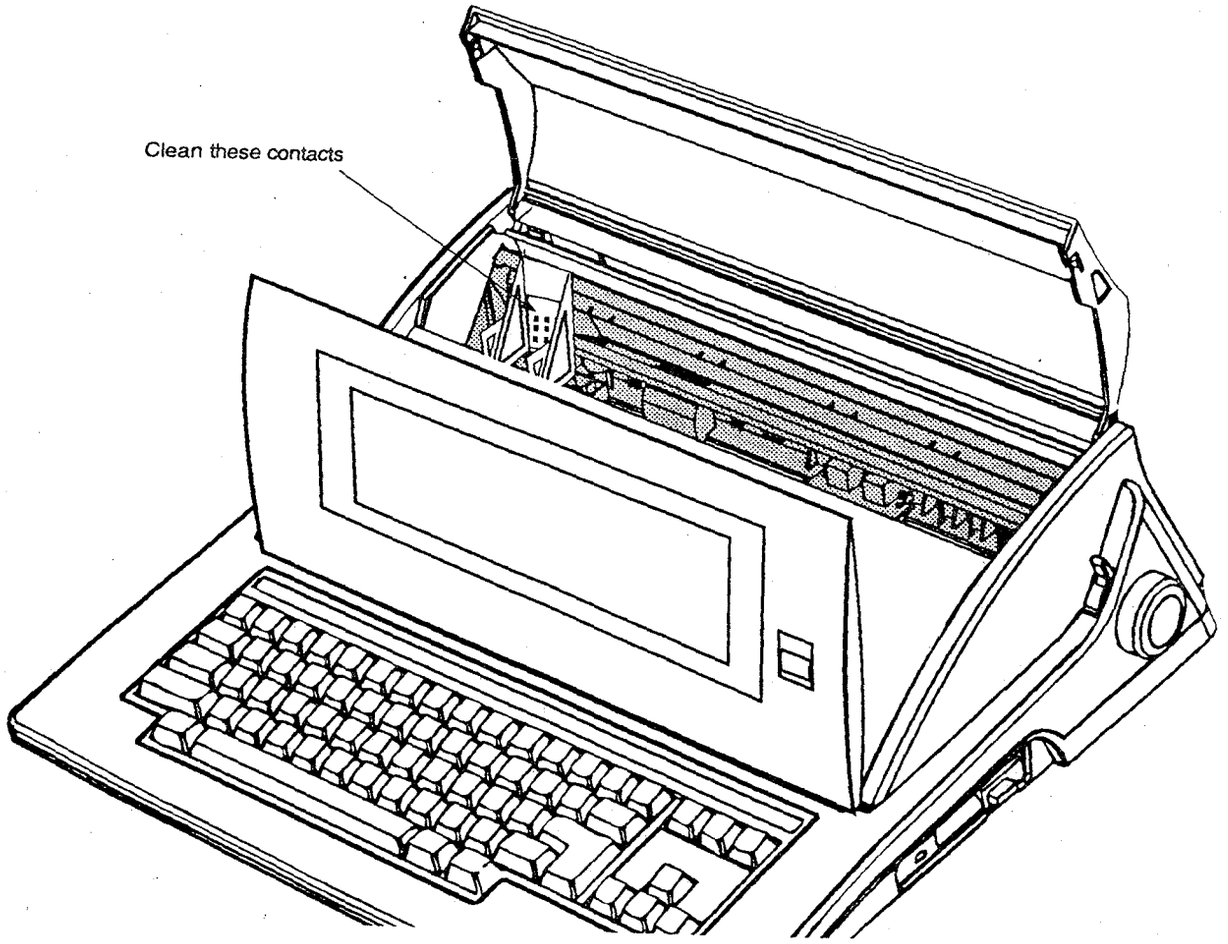
3.3 Cleaning the Bracket Contacts (Carriage)

(1) Press **CODE + INK CHG** to move the carriage assembly to the home (left side) position.

(2) Without turning off the machine, unplug the DC jack from the DC plug connector on the rear of the machine. *(This will keep the carriage assembly from returning to the maintenance station).*

(3) Turn the machine off and remove the ink cartridge.

(4) With a clean, *dry* cloth, clean the gold-colored contacts on the ink cartridge bracket as shown below:



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APPENDIX A

Specifications

1. Electrical System

(1)	Main PCB Size:	156 × 190 mm
(2)	CPU:	H8 3003
(3)	ROM:	2 MB (3 fonts)
(4)	RAM:	128KB × 2
(5)	FDC:	HD63266F
(6)	KB Matrix:	8 × 9
(7)	Power PCB Size:	156 × 62.5 mm
(8)	Output Voltage:	24v, 5v (8v for Europe models)
(9)	Display (LCD):	480 × 128 (Backlit LCD for Europe models)
(10)	Printer:	mono
(11)	CA Step Motor:	Constant Current Control
(12)	LF Step Motor:	Constant Voltage Control
(13)	HP Sensor:	Leaf Type Switch
(14)	PE Sensor:	Optical Sensor
(15)	Auxiliary Memory:	FDD (1.44 MB/720KB) MFM form (MS-DOS format) 3.5″ 2HD, 3.5″ 2DD

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2. Printing

(1) Printing Method: Lexmark Thermal Ink Jet

(2) Heads: Color/Mono

(3) Head Type: Thermal Ink Jet

(4) Nozzle (mono) 50 active + 6 nozzles (1/300″ spots/inch)

(5) Head weight: 74 g maximum (full)
36 g minimum (empty)

(6) Ink Color: Black

(7) Head Cartridge
Set Force: 4,000 g maximum
Release Force: 2,000 g maximum

(8) Printing Capacity:

Max. Paper Width:	304.70 mm (12.0″)
Max. Printing Width:	231.14 mm (9.1″)
Possible Printing Area:	except 12.7mm (1/2″) from top and bottom, and 25.4mm (1″) area from bottom

(9) Paper Sizes: length (a): 100 to 364 mm (3.94 to 14.33″)
width (b): 100 to 304.8 mm (3.94 to 12.0″)
b:a=1:0.5 to 1:1.5

(10) Base Paper Handling Position: left side

(11) Paper Type:
letter: 215.9 × 279.4 mm (8.5 × 11.0″)
legal: 215.9 × 355.6 mm (8.5 × 14.0″)
B4: 257 × 364 mm (10.11 × 14.33″)
B5: 182 × 257 mm (7.17 × 10.2″)
A4: 210 × 297 mm (8.27 × 11.69″)
executive: 184 × 267 mm (7.24 × 10.51″)
A5: 148 × 210 mm (5.83 × 8.27″)
legal post card (Japanese): 100 × 148 mm (3.94 × 5.83″)
paper weight: 180 g/sqm
thickness: 0.22 mm (0.0087″)
Ground or recycled paper can contain up to 40% de-inked or 50% post-mill fiber
Chemical wood pulp fiber
Transparencies: IBM 4079 printer original film

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(12) Paper Cotton Fiber Content: 0 to 100%

(13) Paper Weight: 60 to 90 g/sqm (16 to 24 lb)

(14) Paper Thickness: 0.071 to 0.18 mm (0.0028 to 0.007")

(15) Print Speed: LQ: 160 cps; "Ink Saver Mode": 160 cps

(16) Printing Direction: text: bi-directional (accuracy ±0.2 mm)
graphics: unidirectional (accuracy ±0.05 mm)

(17) Cartridge Yield: up to 1,000 pages of text at 5% (1,170 characters, 238k ink drops)

(18) Carriage Driving Resolution: 1.968spmm (50 spi) full step;
3.937spmm (100 spi) at 1/2 step

(19) Acoustics:
Printing noise: 55 dB maximum (1m, A Scale fast)

(20) Reliability

Durable life time:	5-year printing quality or 30,000,000 characters
Mean Time Between Failure:	2,000 hour minimum
Ink cartridge change duration:	500 times
Head travel duration:	700,000 times
Head initiation duration:	3,000 times
Paper feed duration:	2,500,000 lines (1/6" line)
Paper release lever duration:	3,000 times
Allowable temperature range:	+10 – +40°C (+15 – +35°C for best print quality)
Allowable relative humidity:	20 – 80% (20 – 70% for best print quality)

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3. Keyboard

(1)	Keying system:	Conductive-rubber contact (plus Koala 1 actuator system)
(2)	Construction:	PCB: multi-layer printed FPC (single-sheet) Rubber: silicon rubber with conductive Actuator: Koala style with 2 cranks
(3)	Keystroke:	3.8 mm ±0.3mm (touch force 300g)
(4)	Key Touch Load:	60 g ±20 g (except space bar: 70 g ±30 g)
(5)	Gap between key tops & KB panel:	1.0 mm – 2.0 mm
(6)	Gap between key tops:	0.8 mm – 1.0 mm
(7)	Keyboard Features:	Style: fixed-type Shape: step key Key Roll-over: limited key Total keys: 65 Key touch load: ≤ 150 g Pressure resistance: smooth return of keytop after 3 kg Key top take-off force: ≥ 0.7 kg (except space bar: ≥ 1 kg)

4. Monitor (LCD)

(1)	LCD Screen Size:	80 columns × 14 lines (480 × 128 dots)
(2)	Character Dot Number:	9 × 6 dots (including underline)
(3)	Tilt Function:	Yes

(4) Display Control

- Resolution: 480 x 128 DPI
- VRAM size: 7.5 KB in main RAM
- Display: without the gray scale, just dot on/off

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5. Floppy Disk Drive (FDD)

(1)	Size:	1.44Mb (3.5″)
(2)	Application Disk:	MF-2DD or 2HD
(3)	FDD Controller	Hitachi HD63266F

6. Power Requirements (US)

(1) Source Voltage: 110-120V (60Hz)

(2) AC Adaptor:

Power Input:	11.5V, 2.2A
Power Consumption:	35W
AC Line Noise:	1kV (min.) (pulse duration 50, 200, 1,000 ns)
Rush Current:	30A (max.)
Instantaneous Power Outages:	– will not malfunction with power outages of up to 1 cycle/50-60Hz

7. Environmental Tolerance

(1) Durability

Keyboard cycles:	1,000,000 times/key
Top cover operation cycles:	3,000 times
Paper support operation cycles:	3,000 times
LCD Cover operation cycles:	6,000 times

(2) Physical Environment

Vibration cycles:	IMV vibration test machine 5–55 Hz, each direction 0.1 G – no operation error after 30-minute test
Edge drop test:	50 mm edge drop – no damage
Package drop test:	80 cm/6-side drop – no damage to product
Temperature:	
Range:	+10 – +40°C
Thermal shrinkage:	2 hours &5 cycles between -40°C and +70°C – no damage to product
Cold-start:	power on after 2 hours at 0°C – no operation error (print quality excluded)
Storage:	48 hours at -20°C, +60°C, and +45°C at 95% relative humidity – no damage to product

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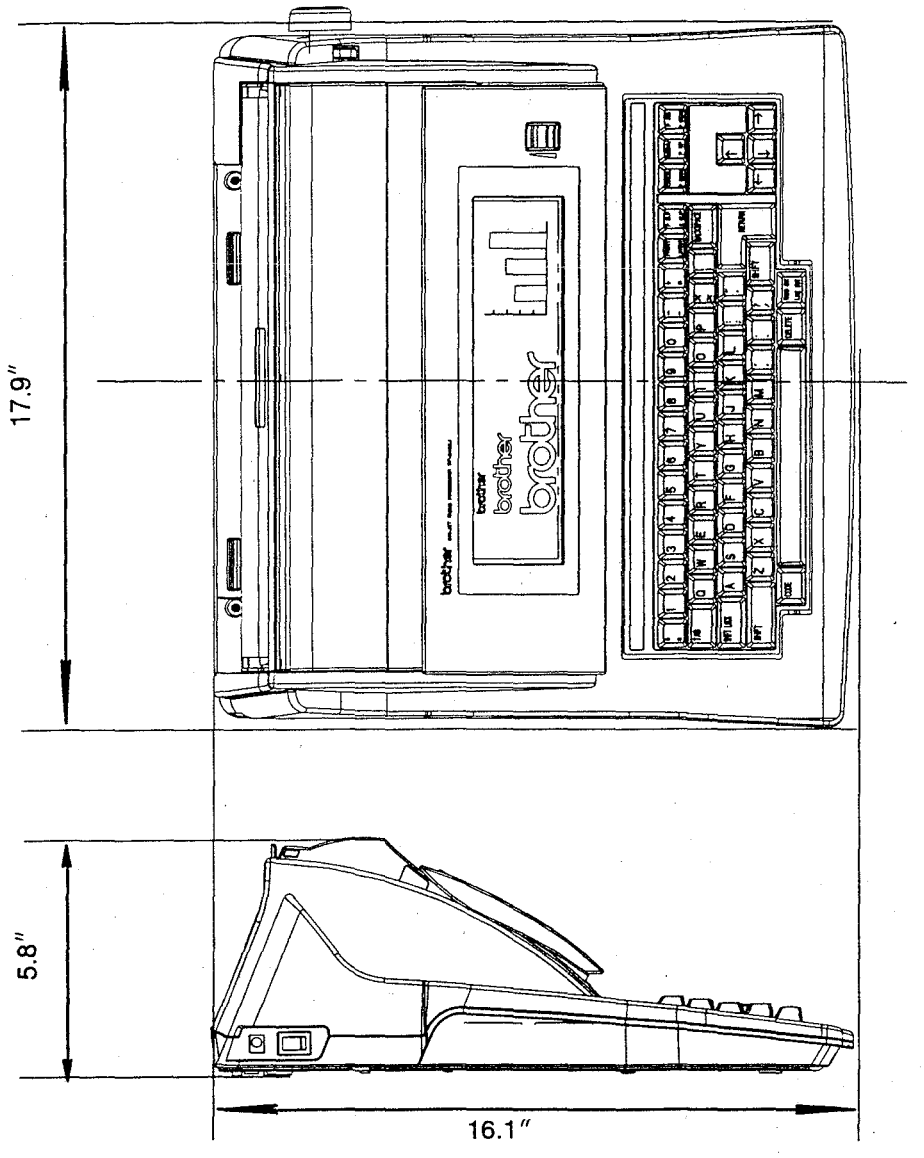
8. Dimensions & Weight

(1) Dimensions: 16.1 (d) × 17.9 (w) × 5.8 (h) in.

(2) Weight: 11.5 lbs. (5.2kg)



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9. Optional Equipment:

Auto Cut-Sheet Feeder (ACF)

(1) Paper Specifications:

- Size: US letter, A4, & post card
- Weight: 16 – 24 lb. (55–78kg)
- Thickness: 0.07 – 0.15 mm
  0.22 mm (postal card size only)

(2) Paper Set Capacity:

- Feeder Tray: 3.0 mm max. (30 sheets of 20lb paper)
  15 sheets for post card
- Front Tray (stacker): same as feeder tray

(3) Performance/Error Ratio:

- multi-feeds: 1/100 sheets (avg.)
- jam/misfeed: 1/200 (avg.)
- Misc. (nick, wrinkle, dogear, etc.): 1/100 (avg.)

NOTE: The above results were achieved under the following conditions:
Temperature: 15 – 25° C
Relative Humidity: 45 – 70%
Paper: 20lb, A4 & US letter

(4) Environmental Conditions:

- Operation: 10 – 35° C, 30 – 80% relative humidity
- Storage (re-packaged): -20 – 60° C; 5 – 95% relative humidity

(5) Reliability:

Service Life: 5 years or 12,000 sheets printed

Mean Time Between Failure (MTBF): 2,000 hours (minimum)

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